

**From:** [Tracy Hillman](#)  
**To:** ["Aaron Jackson"](#); ["Andrew Gingerich"](#); ["Bob Rose"](#); ["Brad James"](#); ["Bryan Nordlund"](#); ["Chad Jackson"](#); ["Corey Wright"](#); ["Dave Burgess"](#); [Bitterman, Deborah](#); ["Donella Miller"](#); [Kunz, Heidi](#); ["Jason McLellan"](#); ["Jeff Korth"](#); [Osborn, Jeff](#); ["Joe Miller"](#); ["Josh Murauskas"](#); ["Justin Yeager"](#); ["Katrina Simmons"](#); [Truscott, Keith](#); ["Keith Vradenburg"](#); [Ken Finicle](#); ["Kirk Truscott"](#); [Keller, Lance](#); [Matthew Kerec](#); [Smith, Michelle](#); ["Mike Clement"](#); ["Pat Irle"](#); ["Patrick Verhey"](#); ["Paul Anders"](#); ["Ralph Lampman"](#); ["RD Nelle"](#); ["Reed Glesne"](#); [Hays, Steve](#); [Hemstrom, Steven](#); ["Steve Lewis"](#); ["Steve Rainey"](#); ["Susan Rosebrough"](#); [Hatmaker, Teneille](#); ["Tom Skiles"](#); ["Travis Maitland"](#); [Frantz, Waikele M.](#)  
**Cc:** [Sokolowski, Rosana](#)  
**Subject:** RRRF: June Meeting of the RRRF  
**Date:** Tuesday, June 03, 2014 7:18:42 PM  
**Attachments:** [2013 Second Draft BiOp Report 053014 Corrected.docx](#)

---

RRFF,

Attached for your review is the second draft of the Five-Year Biological Objectives Report. This draft contains responses to your comments and also includes a significant format change as requested by Ecology. Under the original schedule, comments on the second draft were to be due on 8 June. However, because the release of the second draft report was delayed, Chelan PUD is proposing a review period to 21 June. We will discuss schedules during the meeting tomorrow. Chelan PUD apologizes for the delay in the release of the second draft.

Please let me or Steve Hemstrom know if you have questions.

Thanks,  
Tracy

---

**From:** Tracy Hillman [mailto:[tracy.hillman@bioanalysts.net](mailto:tracy.hillman@bioanalysts.net)]  
**Sent:** Wednesday, May 28, 2014 4:55 PM  
**To:** 'Aaron Jackson'; 'Andrew Gingerich'; 'Bob Rose'; 'Brad James'; 'Bryan Nordlund'; 'Chad Jackson'; 'Corey Wright'; 'Dave Burgess'; 'Deborah Bitterman'; 'Donella Miller'; Heidi Kunz; 'Jason McLellan'; 'Jeff Korth'; 'Jeff Osborn'; 'Joe Miller'; 'Josh Murauskas'; 'Justin Yeager'; 'Katrina Simmons'; 'Keith Truscott'; 'Keith Vradenburg'; 'Ken Finicle'; 'Kirk Truscott'; 'Lance Keller'; 'Matthew Kerec'; 'Michelle Smith'; 'Mike Clement'; 'Pat Irle'; 'Patrick Verhey'; 'Paul Anders'; 'Ralph Lampman'; 'RD Nelle'; 'Reed Glesne'; 'Steve Hays'; 'Steve Hemstrom'; 'Steve Lewis'; 'Steve Rainey'; 'Susan Rosebrough'; Teneille Hatmaker; 'Tom Skiles'; 'Travis Maitland'; 'Waikele Frantz'  
**Subject:** RRRF: June Meeting of the RRRF

Hello RRRF,

This confirms the next meeting of the RRRF. The meeting is set for Wednesday, 4 June from 1:00 to 4:00 pm at the [Chelan PUD Second Floor Conference Room](#) in Wenatchee, WA. If you are unable to attend in person, the conference number is 1-877-668-4493 (Access Code: 23162418).

Attached are the following items for your review:

- Draft Agenda for the June Meeting.
- Draft May meeting notes.
- Draft February Juvenile Sturgeon Workshop Notes

I also attached for your files the final April meeting notes and the final WDFW White Sturgeon

Standardized Fish Health Protocol.

Let me know if you have any changes or additions to the agenda, or if you cannot attend the meeting.

Thanks,

Tracy

---

**Tracy W. Hillman, Ph.D.**

Senior Ecologist

BioAnalysts, Inc.

4725 N. Cloverdale Rd, Suite 102

Boise, ID 83713 USA

Tel: 208-321-0363

Cell: 208-867-2889

Fax: 208-321-0364

[tracy.hillman@bioanalysts.net](mailto:tracy.hillman@bioanalysts.net)

[www.bioanalysts.net](http://www.bioanalysts.net)

---

# **ROCKY REACH BIOLOGICAL OBJECTIVES 2013 STATUS REPORT**

**LICENSE ORDERING PARAGRAPH D, APPENDIX A, SECTION 5.3(3)**

**Second Draft**

**ROCKY REACH HYDROELECTRIC PROJECT  
FERC Project No. 2145**

**May 30, 2014**



**Public Utility District No. 1 of Chelan County  
Wenatchee, Washington**

---

---

## TABLE OF CONTENTS

---

<b>SECTION 1: INTRODUCTION.....</b>	<b>1</b>
<b>SECTION 2: ROCKY REACH HABITAT CONSERVATION PLAN (HCP) .....</b>	<b>7</b>
2.1 Objective: HCP Plan Species 91% Project Passage Survival.....	7
2.2 Objective: HCP Plan Species NNI Hatchery Production Achieves 7% .....	11
2.3 Objective: HCP Plan Species Tributary Fund Implements Habitat improvements for NNI .....	14
2.4 Objective: HCP Plan Species Adult Passage Survival .....	15
<b>SECTION 3: ROCKY REACH BULL TROUT MANAGEMENT PLAN .....</b>	<b>19</b>
3.1 Objective: Incidental Take not exceeded - Bull trout Adult Upstream Passage 2005-2008.....	19
3.2 Objective: Incidental Take - Bull Trout Adult Downstream Migration 2005-2008.....	22
3.3 Objective: Incidental Take Not Exceeded - Predator Control Programs 2005-2008.....	23
3.4 Objective: Incidental Take not exceeded- Sub-Adult Downstream Migration 2005-2008 .....	24
3.5 Objective: Incidental Take not exceeded- Sub-Adult Rearing in Reservoir 2005-2008.....	25
<b>SECTION 4: WHITE STURGEON .....</b>	<b>29</b>
4.1 Objective: White Sturgeon Natural Reproduction Potential .....	29
4.2 Objective: Increase the White Sturgeon Population in the Reservoir through Supplementation Commensurate with Habitat Carrying Capacity .....	31
4.3 Objective: Success in Creating Population with Stable Age-Structure Allowing Limited Harvest .....	34
<b>SECTION 5: PACIFIC LAMPREY .....</b>	<b>36</b>
5.1 Adult Upstream Passage Success .....	36
5.2 Objective: Avoid and minimize Projects impacts on rearing habitat .....	53
5.3 Objective: No Net Impact .....	58
<b>SECTION 6: RESIDENT FISH.....</b>	<b>61</b>
6.1 Objective: No Negative Impacts on Native, Non-Stocked Resident Fish Species .....	61
<b>SECTION 7: LITERATURE CITED.....</b>	<b>65</b>

## **LIST OF TABLES**

Table 1-1. Biological Objectives and implementation measures for the Rocky Reach Fish Management Plans in support of existing and designated uses. ....	3
Table 2-1. Rocky Reach Project juvenile Project Survival estimates and study years for steelhead, spring Chinook, and sockeye at Rocky Reach. ....	8
Table 2-2. Juvenile, Adult, and Combined Survival for steelhead, spring-run Chinook, and sockeye as measured during HCP studies at the Rocky Reach Project. ....	8
Table 2-3. Summary of HCP Phase Designations, Project survival estimates and dates achieved for all HCP Plan Species at Rocky Reach. ....	9
Table 2-4. Hatchery Compensation Plan juvenile fish production to fulfill NNI requirements under the Rocky Reach HCP by 2013. Initial production levels expired with year 2013 smolt releases; recalculated smolt production levels are set for the 2014-2023 releases. Inundation production levels are not subject to recalculation. Recalculated production includes adjustments for measured increases in project survival and hatchery performance, in addition to changing population dynamics in the mid-Columbia River Basin. ....	13
Table 2-5. Tributary habitat projects funded through the Rocky Reach HCP Plan Species Account, 2004-2013. ....	15
Table 2-6. Wild and hatchery-origin adult spring Chinook PIT detections and conversion rate (passage survival) estimates (\$̂) at the Rocky Reach Project, 2009-2011. ....	16
Table 2-7. Wild-origin adult sockeye PIT detections and conversion rate estimates (passage survival, \$̂), adjusted for harvest, at the Rocky Reach Project, 2010-2012. ....	17
Table 2-8. Adult wild and hatchery-origin steelhead PIT detections and conversion rate (passage survival) estimates (\$̂), adjusted for harvest, at the Rocky Reach Project, 2010-2012. ....	17
Table 3-1. Authorized Incidental Take levels of bull trout issued by the USFWS for Rocky Reach Project Elements, May 2004 through December 2008. ....	20
Table 3-2. Revised Incidental Take levels for bull trout issued in 2008 by the USFWS for Rocky Reach Project License Elements and the associated quantitative take levels for each element (USFWS 2008). ....	21
Table 3-3. Monthly and total annual counts of bull trout passing Rocky Reach Dam (fishway window counts) 2005-2013. ....	22
Table 3-4. Pikeminnow removed from Rocky Reach Reservoir during Chelan PUD's predator control programs and any associated incidental take of bull trout, 2005-2013. ....	23
Table 4-1. Acoustic Telemetry Receiver Locations in the Rocky Reach Reservoir. ....	30
Table 4-2. Number of juvenile White Sturgeon stocked into Rocky Reach Reservoir, 2011-13. ....	32
Table 4-3. Estimated age and residency time of juvenile white sturgeon stocked into Rocky Reach Reservoir from 2011 through 2014. ....	34
Table 5-1. HD PIT tag antenna sites and descriptions of antenna locations at entrances and within the Rocky Reach adult fishway. ....	38
Table 5-2. HD PIT tag detections of adult Pacific lamprey at Rocky Reach in 2012. ....	40
Table 5-3. HD PIT tag detections of adult Pacific lamprey at Rocky Reach Dam in 2013. ....	40
Table 5-4. Adult Pacific lamprey fishway passage counts at Rocky Reach Dam by month, 2008-2013. ....	41
Table 5-5. Juvenile Lamprey Counts at the Rocky Reach Juvenile Sampling Facility, 2009-2013. ....	45
Table 5-6. Juvenile Pacific lamprey electrofishing sampling locations in Rocky Reach Reservoir, including date, sampling effort, and time of day. ....	56
Table 6-1. Number of fish captured ( <i>n</i> ), the expanded population estimate ( <i>N</i> ), and species composition (%) using expanded population estimates of fish captured in summer pop nets within dense macrophyte mats at specific locations of the Rocky Reach Reservoir. ....	62
Table 6-2. Percent species composition for electrofishing (EB%), fyke netting (FN%), and CPUE electrofishing (EB fish/hour) for summer and fall sampling at Rocky Reach Reservoir. ....	63

## ***LIST OF FIGURES***

---

Figure 3-1. Rocky Reach Reservoir headwater duration curve for 2005 showing range of hourly reservoir (forebay) surface elevations and percent of time the reservoir was at or above a given elevation. ....	26
Figure 3-2. Rocky Reach Reservoir headwater elevation duration curve for 2006 operations showing percent of time the reservoir (forebay) was at or above a given surface elevation. ....	26
Figure 3-3. Rocky Reach Reservoir headwater duration curve for 2007 showing range of hourly reservoir surface elevations (forebay) and percent of time the reservoir was at or above a given elevation. ....	27
Figure 5-1. Rocky Reach dam fishway half-duplex PIT tag antennas locations, RR01-RR07.....	39
Figure 5-2. Unadjusted window count conversion rates of adult Pacific lamprey passing Rock Island Dam and then Rocky Reach Dam from 1983 to 2013.....	42
Figure 5-3. Juvenile lamprey electrofishing sampling locations. ....	55

## **SECTION 1: INTRODUCTION**

The Rocky Reach Hydroelectric Project (Project) is owned and operated by the Public Utility District No. 1 of Chelan County (Chelan PUD). A 43-year License was issued by the Federal Energy Regulatory Commission (FERC) on February 19, 2009. The License Order incorporated conditions regarding Biological Objectives that are anticipated to be achieved at the Rocky Reach Dam and in the Rocky Reach Reservoir (Ordering Paragraph D, Appendix A, Section 5.3(3)).

In accordance with the License Order issued by the FERC and the 401 Water Quality Certification issued by the Washington Department of Ecology (WDOE) on March 17, 2006 (WDOE 2006), Chelan PUD is required to prepare a Biological Objectives Status Report in consultation with the Rocky Reach Fish Forum (RRFF). The draft report is due to WDOE and the RRFF no later than February 1 of every five years, starting with year 5 of the effective date of the New License. Chelan PUD is to consult with the RRFF prior to issuing a final report. If a RRFF member is not in agreement with the draft report or recommendations and has an alternative evaluation or recommendation, Chelan PUD is to include in the final report discussion of the alternative or recommendation and Chelan PUD's reasons for not incorporating the alternative recommendation and/or evaluation. A final report is to be completed and provided to the RRFF no later than March 30 of each year for which the report is due. For this first 5-year Biological Objectives Status Report, additional review and drafting time was approved by WDOE due to the amount of information to be reviewed in the report, requested formatting changes, and to ensure a good foundation for future reports.

This Biological Objectives Status Report summarizes Chelan PUD's progress towards achieving the Biological Objectives to support existing and designated uses set forth in the Rocky Reach Project License 401 Water Quality Certification (Table 1-1). Management Plans with associated Biological Objectives are the:

- 1) Rocky Reach Anadromous Habitat Conservation Plan (HCP);
- 2) Rocky Reach Bull Trout Management Plan;
- 3) Rocky Reach White Sturgeon Management Plan;
- 4) Rocky Reach Pacific Lamprey Management Plan; and
- 5) Rocky Reach Resident Fish Management Plan.

For each Biological Objective, the report reviews: (1) the goal of the Objective, (2) results of monitoring and evaluation programs to achieve the Objective, (3) any modifications made to the programs to achieve the Objective or need for modifications to the programs, (4) the degree to which the Biological Objectives have been achieved, or the prospects for achieving those Objectives in the next reporting period, (5) and any recommendations for management

options (both operational and structural) taken to meet those Biological Objectives to the extent reasonable and feasible.



Table 1-1. Biological Objectives and implementation measures for the Rocky Reach Fish Management Plans in support of existing and designated uses.

Designated Use	Biological Objective	Time Frame	Objective Achieved ?	Actions if Objective Achieved	Alternative Management Actions	Fish Management Plan Action
Salmonid Migration	HCP Plan Species (Chinook, Steelhead, Sockeye, Coho) 91% Project Passage Survival	By 2013	YES	Maintain Action.	Additional Tools (Bypass modifications, spill, other)	HCP Sections 3 and 5
Salmonid Harvest	HCP Plan Species NNI Hatchery Production Achieves 7%	By 2013	YES	Maintain Action. Adjust 7% Production Level Every 10 Years	Modify hatchery facilities or use other method for artificial production	HCP Sections 3 and 8
Salmonid Rearing	HCP Plan Species Tributary Fund Implements Habitat Improvements For NNI	By 2013	YES	Maintain Action.	Modify type of projects funded	HCP Sections 3 and 7
Salmonid Spawning	HCP Plan Species Adult Passage Survival Included in 91% Project Passage Survival.	By 2013	YES	Maintain Action.	Additional Tools	HCP Sections 3 and 5
Bull Trout Adult upstream Passage	Take does not exceed 2% through the upstream fishway.	2005-2008	YES	Maintain Action. Continue appropriate monitoring and the adaptive management process.	Develop and implement a plan, in consultation with the RRFF, to address identified problems.	Bull Trout Plan Sections 4.1.1-4.1.3
Bull Trout Adult downstream Migration	Take does not exceed 5% passing through turbines; 2% passing through spillways; and 2% passing through the downstream bypass.	2005-2008	YES	Maintain Action. Continue appropriate monitoring and the adaptive management process.	Develop and implement a plan, in consultation with the RRFF, to address identified problems.	Bull Trout Plan Section 4.1.2

Designated Use	Biological Objective	Time Frame	Objective Achieved ?	Actions if Objective Achieved	Alternative Management Actions	Fish Management Plan Action
Bull Trout Sub-adult Rearing in the Reservoir	Take does not exceed 2 fish for the fish predator control program.	2005-2008	YES	Maintain Action. Continue appropriate monitoring and the adaptive management process.	Develop and implement a plan, in consultation with the RRF, to address identified problems.	Bull Trout Plan Section 4.1.2
Bull Trout Sub-adult Downstream Migration	Take does not exceed limits when established by USFWS.	As recommended by the RRF	YES	Maintain Action. Continue appropriate monitoring and the adaptive management process.	Pursue feasibility of Project operations of fishway/bypass if migration problems are identified	Bull Trout Plan Sections 4.1.1-4.1.3
White Sturgeon Harvest	Natural reproduction potential	Years 8-10, 13, and 18	NO Ongoing	Maintain Action. Continue appropriate monitoring and the adaptive management process.	Develop and implement a plan, in consultation with the RRF, to address identified problem(s).	White Sturgeon Plan Section 4.4
White Sturgeon Population at Carrying Capacity	Increase the white sturgeon population in the Reservoir through supplementation to a level commensurate with available habitat and allowing for appropriate and reasonable harvest.	Years 3-5, adjust stocking level; Years 6 – 50	NO Ongoing	Maintain Action. Continue appropriate monitoring and the adaptive management process.	RRF to recommend stocking level, broodstock source. Develop and implement a plan, in consultation with the RRF, to address identified problems.	White Sturgeon Plan Sections 4.1-4.3; 4.6
White Sturgeon Harvest	Success in creating population with a stable age-structure that allows for limited harvest	Years 20 to 50	NO Ongoing	Maintain Action. Continue appropriate monitoring and the adaptive management process.	Develop and implement a plan, in consultation with the RRF, to address identified problems.	White Sturgeon Plan Sections 4.1-4.6

Designated Use	Biological Objective	Time Frame	Objective Achieved ?	Actions if Objective Achieved	Alternative Management Actions	Fish Management Plan Action
Pacific Lamprey Adult Upstream and Downstream Migration	Passage success similar to best experience at other similar projects (Adult upstream fish passage as defined by the RRF)	By Year 5	NO Ongoing	(Continuous reassessment every 10 years)	Develop and implement a plan, in consultation with the RRF, to address identified problems.	Pacific Lamprey Sections 4.1.1-4.1.7 and 4.4
Pacific Lamprey Adult Upstream and Downstream Migration	Maintain safe, effective, and timely volitional passage Criteria (as defined by the RRF)	TBD by RRF with 5 year review by RRF	NO Ongoing	Maintain Action. Continue appropriate monitoring and the adaptive management process.	Develop and implement a plan, in consultation with the RRF, to address identified problems.	Pacific Lamprey Sections 4.1.1 to 4.1.7 and 4.4
Pacific Lamprey Juvenile Downstream Migration	Maintain safe, effective, and timely volitional passage Criteria (as defined by RRF)	TBD by RRF with 5 year review by RRF	NO Ongoing	Maintain Action. Continue appropriate monitoring and the adaptive management process.	Develop and implement a plan, in consultation with the RRF, to address identified problems.	Pacific Lamprey Sections 4.2.1 to 4.1.2 and 4.4
Pacific Lamprey Rearing	Avoid and minimize Project impacts on rearing habitat	By Year 5	YES Ongoing	Maintain Action. Continue appropriate monitoring and the adaptive management process.	Develop and implement a plan, in consultation with the RRF, to address identified problems.	Pacific Lamprey Sections 4.3 and 4.4
Pacific Lamprey overall Combined Goal	No Net Impact	TBD by RRF	NO Ongoing	Maintain Action. No additional action needed	Develop and implement a plan, in consultation with the RRF, to address identified problems.	Pacific Lamprey Section 4
Native, Non-Stocked Resident Fish Species	No negative impacts caused by ongoing Project operations	Years 1-4, with subsequent surveys determined by RRF	YES	Maintain Action. No additional action needed.	Develop and implement a plan, in consultation with the RRF, to address identified problems.	Resident Fish Section 4.2



## ***SECTION 2: ROCKY REACH HABITAT CONSERVATION PLAN (HCP)***

### ***Goal***

The goal of the Rocky Reach Anadromous Habitat Conservation Plan (HCP) is for the Rocky Reach Project to attain “Phase III Standards Achieved” for combined juvenile and adult passage survival and achieve No Net Impact (NNI) for each Plan Species (Spring Chinook, Summer-Fall Chinook) per the schedule set forth in the HCP.

### ***2.1 Objective: HCP Plan Species 91% Project Passage Survival***

The Rocky Reach HCP provides a detailed phase designation system for planning, testing, and confirming progress towards achieving survival standards. The primary objective is reaching “Phase III Standards Achieved” which indicates that the appropriate standard has been met or the standard is likely to have been achieved but is yet untested for reasons outside Chelan PUD’s control. In this case, the standard may require periodic review to determine feasibility and ensure that the compensation for a Plan Species remains in compliance with No Net Impact (NNI). NNI consists of two components: (1) 91% Combined Adult and Juvenile Project Survival achieved by project improvement measures implemented within the geographic area of the Project, and (2) 9% compensation for Unavoidable Project Mortality provided through hatchery and tributary programs, with 7% compensation provided through hatchery programs and 2% compensation provided through tributary programs.

### ***Results of Monitoring (Passage Studies)***

Survival and passage of juvenile and adult HCP Plan Species (steelhead, sockeye, spring Chinook, summer/fall Chinook, and coho), as measured through passage studies, is overseen by the HCP Coordinating Committee (HCP CC). By March 30, 2013, Chelan PUD successfully achieved the HCP combined 91% survival standards for all spring migrating Plan Species. The HCP requires that Chelan PUD attain a 91% Combined Adult and Juvenile Survival Standard for the Project when both components can be validly measured over three separate studies. Juvenile survival was estimated with studies in years 2004-2011 (Table 2-1). In total, Chelan PUD conducted 13 juvenile survival studies at Rocky Reach from 2004 through 2011. Ten of those studies were used to assess and attain the juvenile survival standard (93%) at the Project (Table 2-1).

Table 2-1. Rocky Reach Project juvenile Project Survival estimates and study years for steelhead, spring Chinook, and sockeye at Rocky Reach.

Project	Species <sup>1</sup>	Juvenile Survival	HCP Study Years
Rocky Reach	Steelhead	95.79%	2004-2006 (n = 3)
	Spring Chinook	92.37%	2004-2005, 2010-2011 (n = 4)
	Sockeye	93.59%	2006, 2008-2009 (n = 3)

The Combined Adult and Juvenile Project Survival estimate is the mathematical product of the average measured juvenile survival times the average measured adult survival for each species.

Sufficient numbers of PIT (passive integrated transponder) tagged adult spring Chinook salmon returning above Rocky Reach allowed measurement of adult passage survival at Rocky Reach for return years 2009 through 2011. Measurement of adult steelhead and sockeye conversion rates (survival) followed in return years 2010-2012 (Table 2-2). All Combined Adult and Juvenile Survival Standards for spring species were achieved by 2013 at Rocky Reach with standards approved by the HCP CC.

Degree of Achievement of Objective

Because HCP survival standards have been achieved, Chelan PUD recommends to maintain the management actions of annual fishway maintenance at Rocky Reach and continue appropriate monitoring of adult Plan HCP Plan Species passage and conversion rates by monitoring PIT tagged adult fish in the next five-year period at Rocky Reach. The HCP CC has not recommended any additional management actions beyond what Chelan PUD has implemented to achieve the HCP’s combined juvenile and adult survival standards.

Table 2-2. Juvenile, Adult, and Combined Survival for steelhead, spring-run Chinook, and sockeye as measured during HCP studies at the Rocky Reach Project.

Project	Species	Juvenile Survival	Adult Survival	Combined Survival <sup>1</sup>	Year Achieved
Rocky Reach	Steelhead	95.79%	98.93%	<b>94.77%</b>	2012
	Spring Chinook	92.37%	99.90%	<b>92.28%</b>	2011
	Sockeye	93.59%	98.92%	<b>92.58%</b>	2012

<sup>1</sup> Combined survival is the product of juvenile and adult survival estimates (e.g., .9579 × .9893 = 94.77%)

<sup>1</sup> An interim juvenile survival value of 93% for coho was assumed and agreed to by the HCP CC.

Table 2-3. Summary of HCP Phase Designations, Project survival estimates and dates achieved for all HCP Plan Species at Rocky Reach.

HCP Plan Species	Rocky Reach Phase Designation
Spring Chinook Yearlings (ESA Listed)	Phase III Standard Achieved 92.28 % Combined Adult & Juvenile (Aug 30, 2011)
Steelhead (ESA Listed)	Phase III Standard Achieved 95.79 % Juvenile Project (Oct 24, 2006) and 94.77% Combined Adult and Juvenile (January 25, 2013)
Sockeye (Not Listed)	Phase III Standard Achieved 93.59 % Juvenile Project (Dec 17, 2010) and 92.58% Combined Adult and Juvenile (January 25, 2013)
Coho (Not Listed)	Phase III Standard Achieved-Interim (June 26, 2007)
Summer/fall Chinook Sub-yearlings (Not Listed)	Phase III Additional Juvenile Studies (June 25, 2013)

Recommendations and Management Options Taken

*Summer/fall Chinook*

Measurement of sub-yearling juvenile Project Survival at Rocky Reach is not feasible due to technology limitations in juvenile salmon acoustic tag technology and uncertainties surrounding the sub-yearling life history of summer/fall Chinook salmon in the mid and upper-Columbia River Basin. Uncertainties in study feasibility at this time include adequate battery life in tags small enough for subyearling Chinook 70-110 mm in length which dominate the length frequency of rearing fish in the upper mid-Columbia; long downstream migration times (average 24.8 days in 2012 between release at RK 856 and Rocky Reach Dam at RK 762) for these fish through Wells and Rocky Reach reservoirs (Douglas PUD 2013), and non-migration which may occur when subyearlings do not outmigrate their first year, but overwinter and outmigrate the following spring (reservoir-type Chinook).

For all HCP studies to date, to ensure representative fish are used per the Rocky Reach HCP, Chelan PUD utilizes run-of-river fish (juvenile HCP Plan Species) captured at the Rocky Reach juvenile bypass system to conduct all survival studies for the Project. In 2010, the Wells'

HCP Survival Verification Study required that Douglas PUD tag and release 80,000 spring Chinook. It is not reasonably feasible or physically possible to collect these numbers of subyearling Chinook at the Rocky Reach to conduct a PIT study. Due to these limitations, HCP standards for subyearling and adult summer/fall Chinook have not been tested. The Rocky Reach HCP (Chelan PUD 2002) does not consider technology limitations as failure to achieve NNI, stating:

*...The inability to measure a standard due to limitations of technology shall not be construed as a success or a failure to achieve NNI as further explained in Section 5.2.1 "91% Combined Adult and Juvenile Survival" and Section 5.2.2 "93% Juvenile Project Survival" and "95% Juvenile Dam Passage Survival".*

Unlike spring Chinook, steelhead and sockeye, wild-origin subyearling summer/fall Chinook originating from above Rocky Reach Dam in the mid-Columbia are very small fish, and exhibit long outmigration times to pass through reservoirs (Douglas PUD 2013). Recent research demonstrated that PIT tagged subyearling Chinook salmon with fork lengths of between 62 and 104 mm (full range size distribution) took between five and 39 days to migrate between Wells Reservoir and Rocky Reach Dam in 2011 and 2012 (Douglas PUD 2013). Because of these issues, subyearling Chinook survival testing has not occurred at Rocky Reach.

The HCP CC convened a panel of experts in 2010 to discuss challenges and uncertainties associated with measuring sub-yearling survival in the mid-Columbia River. Chelan PUD and HCP committees are currently investigating sub-yearling life history through monitoring at the Rocky Reach Juvenile Bypass System and regional monitoring and evaluation work conducted in the Wenatchee, Methow, and Okanogan rivers. Chelan PUD continues to compensate for unavoidable project mortality through the Hatchery Compensation and Tributary Conservation plans. Numerical abundance of summer/fall Chinook the mid-Columbia River has increased significantly since returns in the 1990s. Adult returns of summer/fall Chinook to Rock Island averaged only 18,650 adults in the 1990s, whereas returns since implementation of the HCPs have averaged 65,976 - a near four-fold increase (2004-2011).

While juvenile acoustic tag studies and adult Project survival studies for subyearling Chinook are not yet feasible at Rocky Reach, the HCP CC voted in 2013 to maintain subyearling Chinook in Phase III (Additional Juvenile Studies) for up to three years (June 2016) at the Rocky Reach Project. Chelan PUD will annually assess improvements in acoustic tag technology and study design, and re-evaluate Project survival study feasibility by 2016.

### *Coho*

On June 26, 2007, the Rocky Reach HCP CC agreed that a coho hatchery compensation program fulfills NNI obligations, as detailed in Section 8.4.3 of the Rocky Reach HCP. Chelan PUD funding is provided to the Yakama Nation to support the Coho Reintroduction Program.



The HCP further acknowledges that compensation for coho will be reassessed if a naturally reproducing population of coho salmon is established by efforts occurring outside of the HCPs. As such, the Coordinating Committees agreed that a survival value of 93% is assumed and that juvenile and adult passage survival studies are not required in the interim of continued hatchery programs for coho reintroduction.

## **2.2 Objective: HCP Plan Species NNI Hatchery Production Achieves 7%**

### Results of Monitoring

To meet hatchery compensation requirements in the Rocky Reach HCP, Chelan PUD has built production capacity or contributed funding to operate 12 hatchery facilities in the mid-Columbia River Basin. These facilities include full life-cycle hatcheries: Chelan Hatchery and Eastbank Hatchery/Rocky Reach Annex; over-winter acclimation facilities: Chiwawa Ponds, Similkameen Ponds, and Chelan Falls Ponds; and other acclimation facilities such as Turtle Rock Island<sup>2</sup>, Dryden Ponds, Carlton Ponds, and Lake Wenatchee Net Pens.<sup>1</sup> Additionally, the Chelan PUD has provided funding and capacity at other facilities not owned by Chelan PUD, such as the Methow and Ringold hatcheries, and Bonaparte and Blackbird acclimation ponds, and is currently co-funding with Grant PUD the construction of the Penticton Sockeye Hatchery in British Columbia. The HCP HC is currently using adaptive management to evaluate brood stock collection options for Chelan PUD's Methow spring Chinook obligations. An HCP Hatchery Committee approved alternative pilot effort to collect Methow spring Chinook broodstock is occurring currently at Rocky Reach Dam.

Chelan PUD also provides operational funding for the new Chief Joseph Hatchery operated by the Confederated Tribes of the Colville Reservation and funding to the Yakama Nation for its Coho Reintroduction Program.

In addition to hatchery culturing capacity, Chelan PUD also funds the operation and maintenance of several traps and weirs to support broodstock collection and management activities in the Wenatchee Basin. These include Tumwater trapping facility, Dryden Left-Bank and Right-Bank trapping facilities, and the Chiwawa Weir. Although their primary function is to support the HCPs' hatchery programs, they also contribute to the management and research activities of the Yakama Nation, National Marine Fisheries Service, US Fish and Wildlife Service, and Washington Department of Fish and Wildlife.

---

<sup>2</sup> The Turtle Rock Island and Wenatchee Net Pen facilities were integral for meeting the first 10 years of HCP-mandated hatchery production, but they are no longer in service for hatchery production. Production obligations reared at those facilities have been shifted to other locations, as approved by the RR HCP Hatchery Committee.

Funding, hatchery infrastructure, and space capacity is provided by Chelan PUD to meet the compensation levels necessary to achieve NNI for all Plan Species. Initial estimated hatchery production levels were based on average adult returns of Plan Species for a baseline period, a 7% compensation requirement, and baseline adult to smolt survival rates for existing mid-Columbia River hatcheries. Hatchery compensation for Plan Species is implemented in accordance with Section 8 of the Rocky Reach HCP, ESA Section 10 permits held by Chelan PUD, and consultations with the Rocky Reach HCP Hatchery Committee.

Hatchery production in excess of the 7% took place as “initial production” through the 2013 (2003-2013) smolt releases. Adjustment of hatchery production levels can occur every ten years of HCP implementation, beginning in 2013 (to adjust production for release years 2014-2023). Adjustments are intended to account for changes in average adult returns, adult-to-smolt survival, and smolt-to-adult survival from hatchery production facilities. The HCP allows Chelan PUD to enter into agreements with other entities for the rearing, release, and monitoring and evaluation of hatchery production. The Hatchery Committee must approve any proposed agreements or trades of production, though it is Chelan PUD’s responsibility to ensure that obligations under the Hatchery Compensation Plan are satisfied. Chelan PUD has received Hatchery Committee approval via a Statement of Agreement for its compensation plan (Approved December 14, 2011) and has built the necessary capacity to meet NNI requirements (Table 2-4).

Field monitoring is used to determine if the hatchery programs are performing as intended. The HCP Hatchery Committee adopted an in-the-field monitoring and evaluation (M&E) approach that guides the assessment of the hatchery programs. The M&E program includes several objectives that focus on monitoring in-hatchery and in-river performance of hatchery-reared smolts, along with long-term monitoring to determine if the hatchery programs are contributing to rebuilding natural populations while conserving their long-term fitness. Monitoring activities include documenting broodstock collection, collection of life-history information, documenting hatchery spawning and rearing activities, juvenile monitoring within streams, and redd and carcass surveys. For all species the M&E program provides broodstock information; hatchery rearing history, release data, and survival estimates; disease information; juvenile migration and productivity estimates; redd counts, distribution, and spawn timing; spawning escapements; and life-history characteristics. The M&E program also addresses compliance with the Endangered Species Act and HCP mandates. In addition to annual reports that have been generated in each year of the HCPs’ implementation, the first comprehensive five year Monitoring and Evaluation report (for Rocky Reach and Rock Island compensation) was completed in May of 2012 (Hillman et al. 2012)

Degree of Achievement of Objective

Chelan PUD has fully achieved the Biological Objective of producing 7% hatchery compensation to achieve NNI under the Rocky Reach HCP. The HCP requires compensation for all Plan Species which includes steelhead, spring Chinook, summer/fall Chinook, sockeye, and Coho. By implementing the Rocky Reach HCP’s hatchery programs, 2003-2013 the HCP Production Objectives have been achieved and are consistent with the overall HCP objectives of rebuilding natural populations and achieving NNI, as well as supporting harvest.

Table 2-4. Hatchery Compensation Plan juvenile fish production to fulfill NNI requirements under the Rocky Reach HCP by 2013. Initial production levels expired with year 2013 smolt releases; recalculated smolt production levels are set for the 2014-2023 releases. Inundation production levels are not subject to recalculation. Recalculated production includes adjustments for measured increases in project survival and hatchery performance, in addition to changing population dynamics in the mid-Columbia River Basin.

Plan	Species	Inundation (fixed)	Initial production	NNI Rocky Reach Production		Location(s)
				Calculated 7%	Recalculated 7%	
	Spring Chinook	-	144,000	90,000	60,516	Methow/New program
		-	0	0	63,000	Chief Joseph
	Steelhead	165,000	35,000	30,000	9,000	Chiwawa
	Summer Chinook	400,000	0	0	0	Chelan Falls
		-	200,000	200,000	176,000	Chelan Falls
		-	200,000	0	0	Carlton
		-	0	0	91,000	Similkameen Chief Joseph (subs)
		-	0	0	49,000	(subs)
	Sockeye	-	0	300,000	Skaha program	Penticton

Recommendations and Management Options Taken

The Rocky Reach HCP Hatchery Committee has worked to develop and has utilized many recommendations and management options developed by the Hatchery Committee over the first 10 years of HCP implementation (2003-2013). Refer to the Rocky Reach HCP Annual Reports for all activities and decisions (Statements of Agreement) made by the Rocky Reach HCP Hatchery Committee in the last five years, 2008-2013.

### **2.3 Objective: HCP Plan Species Tributary Fund Implements Habitat improvements for NNI**

#### Results of Monitoring

The HCP Tributary Fund was established to provide funding for fish habitat restoration projects that would be expected, over time, to contribute improvement in the production of Plan Species. Since it is very difficult to measure fish production improvements for individual fish habitat improvements, the HCP specifies that 2% of NNI is credited to survival for the annual contribution of \$229,800 (in 1998 dollars, adjusted annually for inflation) to the Rocky Reach Plan Species Account. These contributions have been used to provide funding, in most cases matching funds, for 25 projects. The expenditures allocated from the Rocky Reach Plan Species Account for these projects were \$1,824,999, while the total project costs allocated from all funding sources were \$6,014,180. The unallocated balance of the Rocky Reach Plan Species Account, as of January 15, 2014, is \$1,274,994. Habitat projects that have received funds from the Rocky Reach Plan Species Account are shown in Table 2-5.

#### Degree of Achievement of Objective

In the period 2004 through 2013, Chelan PUD and the HCP Tributary Committee have successfully funded and implemented 25 different tributary habitat projects in the Wenatchee, Entiat, Methow, and Okanagan river basins from the Rocky Reach Plan Species Account. Biological Objectives for achieving NNI with Fund compensation and implementation management were fully achieved over the last five years. The committee process of reviewing and selecting habitat projects is functioning well. No changes or modifications to the existing process have been recommended by the Tributary Committee or Chelan PUD for the next 5-year period (2014-2018) of the Rocky Reach License.

#### Recommendations and Management Options Taken

The Rocky Reach HCP Tributary Committee has made multiple recommendations and has utilized a number of management options it retains to review and accept funding proposals for the HCP Tributary Fund (2003-2013). Please refer to Rocky Reach HCP Annual Reports (2008-2013) for all activities and decisions made by the Rocky Reach HCP Tributary Committee.

Table 2-5. Tributary habitat projects funded through the Rocky Reach HCP Plan Species Account, 2004-2013.

Rocky Reach Plan Species Account							
Project Name	Sponsor	Fund Type	Project Type	Total Cost	Tributary Contribution	Tributary Contribution (actual to date)	Project Status
05 Entiat Instream Structure Engineering	Cascadia Conservation District	General	Instream Structures	\$59,340	\$59,340	\$48,659	Complete
05 Twisp River Conservation Acquisition	Methow Salmon Recovery Found	General	Protection	\$200,835	\$40,000	\$40,000	Complete
05 Clees Well and Pump	Okanogan Conservation District	General	Instream Flows	\$40,875	\$15,000	\$14,924	Complete
05 Entiat Instream Habitat Improvements	Chelan County NRD	General	Instream Structures	\$250,000	\$37,500	\$37,500	Complete
06 Entiat PUD Canal Juv Habitat Enhancement	Cascadia Conservation District	Small	Instream Structures	\$23,640	\$23,640	\$3,059	Complete
07 LWD Removal & Relocation	Chelan County NRD	Small	Instream Structures	\$5,000	\$5,000	\$871	Complete
07 LWD/Rootwad Acquisition & Transport	Cascadia Conservation District	Small	Instream Structures	\$24,600	\$24,600	\$24,600	Complete
07 Harrison Side Channel	Chelan County NRD	General	Off-Channel Habitat	\$797,300	\$90,105	\$68,647	Complete
08 Entiat PUD Canal Log-Boom Installation	Cascadia Conservation District	Small	Instream Structures	\$10,660	\$7,160	\$4,526	Complete
08 Twisp River Riparian Protection (Buckley)	Methow Conservancy	General	Protection	\$299,418	\$89,825	\$89,825	Complete
08 Below the Bridge	Cascadia Conservation District	General	Instream Structures	\$398,998	\$150,000	\$115,353	Complete
09 Foreman Floodplain Reconnection	Chelan County NRD	General	Off-Channel Habitat	\$0	\$0	\$0	Cancelled
09 Entiat NFH Habitat Improvement Project	Cascadia Conservation District	General	Off-Channel Habitat	\$285,886	\$61,373	\$61,373	Complete
10 Methow Subbasin LWD Acquisition & Stockpile	Methow Salmon Recovery Found	Small	Instream Structures	\$50,000	\$50,000	\$49,914	Complete
11 Chewuch River Permanent Instream Flow Project	TU – Washington Water Project	General	Instream Flow	\$1,200,000	\$325,000	\$306,752	Complete
11 Christianson Conservation Easement	Methow Conservancy	Small	Protection	\$16,350	\$15,000	\$15,000	Complete
12 Entiat Stormy Reach Phase 2 Acquisition	Chelan-Douglas Land Trust	General	Protection	\$165,000	\$46,800	\$44,003	Complete
12 Silver Protection	WA Dept. of Fish & Wildlife	General	Protection	\$660,000	\$125,000	\$0	In progress
12 Nason Creek Lower White Pine Coulter Creek Barrier Replacement	Chelan County NRD	General	Fish Passage	\$83,126	\$12,469	\$0	In Progress
12 Nason Creek LWP Alcove Acquisition	Chelan-Douglas Land Trust	General	Protection	\$353,000	\$72,000	\$72,000	Complete
13 Fish Passage at Shingle Creek Dam	Okanogan Nation Alliance	General	Fish Passage	\$59,225	\$180,950	\$0	In progress
13 Upper Beaver Habitat Improvement Channel Restoration	Methow Salmon Recovery Found	General	Channel Restoration	\$674,600	\$102,613	\$24,987	In Progress
13 Okanogan Basin Stream Discharge Monitoring	Colville Confederated Tribes	Small	Instream Flows	\$90,954	\$74,984	\$0	In Progress
14 Silver Side Channel Design	CC Fisheries Enhancement Group	General	Design	\$180,733	\$132,000	\$5,186	In Progress
14 Similkameen RM 3.8 Design	Okanogan Conservation District	General	Design	\$84,640	\$84,640	\$0	In Progress
<b>Total</b>				<b>\$6,014,180</b>	<b>\$1,824,999</b>	<b>\$1,027,178</b>	
<b>Current Rocky Reach Plan Species Account Balance (unallocated): \$1,274,933.90</b>							

**2.4 Objective: HCP Plan Species Adult Passage Survival**

Results of Monitoring

Adult passage survival through Rocky Reach is a measure of the probability that a HCP Plan Species adult fish (salmon or steelhead) that is detected at the downstream end of the dam’s tailrace survives passage through the tailrace, the dam, and the dam’s reservoir (Buchanan and Skalski 2011, 2012). Adult fish are monitored adult conversion rates are calculated from the

number of unique PIT tagged adults detected at the upstream end of the Project divided by the number detected at the downstream end of the Project's (tailrace). The estimate of survival through the Rocky Reach Project is estimated by the conversion from the Rock Island Dam fishways to the Wells Dam fishway. Survival rates shown for Rocky Reach are a minimum estimate of Project survival as the estimate includes passage through *multiple Projects* to allow for complete estimation of Rocky Reach passage survival. Some non-Project mortality may be included in conversion rate estimates, including losses from adult fish straying to tributaries, removal of PIT tagged fish through harvest in reservoirs, and missed-detections at the upstream dam. Tables 2-6, through 2-8 show the three-year arithmetic average survival rates estimated for each species (95% confidence).

Table 2-6. Wild and hatchery-origin adult spring Chinook PIT detections and conversion rate (passage survival) estimates ( $\hat{S}$ ) at the Rocky Reach Project, 2009-2011.

Year	Unique PIT Detected Fish		Rock Island to Wells Conversion Rate			Rocky Reach Conversion Rate		
	Rock Island	Wells	$\hat{S}$ Estimate	SE	95% CI	$\hat{S}$ Estimate	SE	95% CI
2009	22	22	1.0000	0	(0.9164, 1.0000)	1.0000	0	(0.9573, 1.0000)
2010	45	45	1.0000	0	(0.9582, 1.0000)	1.0000	0	(0.9789, 1.0000)
2011	166	165	0.9940	0.006 0	(0.9738, 0.9997)	0.9970	0.0030	(0.9868, 0.9998)
Avg	-	-	0.9980	0.002 0	(0.9941, 1.0000)	<b>0.9990</b>	0.0006	(0.9979, 1.0000)

Table 2-7. Wild-origin adult sockeye PIT detections and conversion rate estimates (passage survival,  $\hat{S}$ ), adjusted for harvest, at the Rocky Reach Project, 2010-2012.

Year	Unique PIT Detected Fish		Rock Island to Wells Conversion Rate			Rocky Reach Conversion Rate		
	Rock Island	Wells	$\hat{S}$ Estimate	SE	95% CI	$\hat{S}$ Estimate	SE	95% CI
2010	536	525	0.9897	0.0031	(0.9824, 0.9946)	0.9909	0.0031	(0.9836, 0.9958)
2011	370	355	0.9795	0.0052	(0.9675, 0.9882)	0.9891	0.0053	(0.9770, 0.9978)
2012	974	950	0.9876	0.0025	(0.9820, 0.9919)	0.9876	0.0025	(0.9820, 0.9919)
Avg	-	-	0.9856	0.0022	(0.9813, 0.9899)	<b>0.9892</b>	0.0022	(0.9849, 0.9935)

Table 2-8. Adult wild and hatchery-origin steelhead PIT detections and conversion rate (passage survival) estimates ( $\hat{S}$ ), adjusted for harvest, at the Rocky Reach Project, 2010-2012.

Year	Unique PIT Detected Fish		Rock Island to Wells Conversion Rate			Rocky Reach Conversion Rate		
	Rock Island	Wells	$\hat{S}$ Estimate	SE	95% CI	$\hat{S}$ Estimate	SE	95% CI
2010	67	64	0.9861	0.0261	(0.9824, 0.9946)	0.9931	0.0131	(0.9673, 1.0188)
2011	354	351	1.1343	0.0094	(1.1158, 1.1527)	1.0650	0.0044	(1.0564, 1.0737)
2012	292	289	0.9897	0.0059	(0.9820, 0.9919)	0.9948	0.0030	(0.9867, 0.9987)
Avg	-	-	0.9856	0.0094	(0.9813, 0.9899)	<b>1.00</b>	0.0047	(1.0084, 1.0269)

Degree of Achievement of Objective

Chelan PUD has achieved adult passage survival standards set in the Rocky Reach HCP. The HCP metric for adult survival is 98%. Adult conversion rates (upstream passage survival) through Rocky Reach were estimated using adult PIT tagged spring Chinook passing from Rock Island Dam to Wells Dam in years 2009 through 2011, and for steelhead and sockeye salmon in years 2010 through 2012 (Buchanan and Skalski 2011, 2012). The three-year mean Chinook passage survival was estimated to be 99.90%. Adult Sockeye and steelhead survivals were estimated to be 98.92% and 100%, respectively.

Chelan PUD has not measured adult passage survival for summer/fall Chinook due to intense sport-fishing harvest that results in significant loss of PIT tagged fish in the river reach between Rock Island Dam and Wells Dam. HCP combined survival (both juvenile and adult combined) estimates are not yet possible because juvenile passage survival is yet to be measured in the Rocky Reach Project. Based on high passage survival measured at Rocky Reach for adult spring-migrating species – sockeye, spring Chinook, and steelhead - Chelan PUD believes adult passage survival is also high for summer/fall Chinook but will continue to assess PIT tag adult passage data

Recommendations and Management Options Taken

With Phase III Standards Achieved for spring Chinook, steelhead and sockeye, the Rocky Reach HCP Coordinating Committee requires that Chelan PUD conduct a 10-year “check-in” passage survival study (juveniles and adults) at Rocky Reach in 2021 to verify that HCP Phase III adult and juvenile Survival Standards are being maintained at the Project.



## **SECTION 3: ROCKY REACH BULL TROUT MANAGEMENT PLAN**

### **Goal**

The goal of the Bull Trout Management Plan (BTMP) is to identify, develop, and implement measures to monitor and address any impacts on bull trout resulting from Project operations and facilities in a manner consistent with the U S Fish and Wildlife Service (USFWS) draft bull trout recovery plan. The BTMP measures are designed specifically to meet the following objectives: 1) minimize and remain within Incidental Take levels while identifying and addressing any adverse ongoing Project-related impacts on adult bull trout passage through the term of the New License; 2) investigate potential Project-related impacts on upstream and downstream passage of sub-adult bull trout through the Rocky Reach Dam and reservoir; and 3) investigate the potential for sub-adult entrapment or stranding in off-channel or backwater areas of the Rocky Reach Reservoir as a result of Project operations.

The 401 Water Quality Certification for the Rocky Reach Project contains a Biological Objective to remain within (not exceed) incidental take allowances authorized by the U.S. Fish and Wildlife Service (USFWS) for various Project Elements of the Rocky Reach License are not exceeded in any annual period. Allowable incidental take levels (Table 3-1) for the period 2005 through 2008 are shown in the Rocky Reach 401 Certification. These take levels were issued to Chelan PUD from the USFWS' 2004 Biological Opinion on FERC's Rocky Reach License Amendment to incorporate Chelan PUD's anadromous HCP into the License (USFWS 2004). Subsequently in 2008, the USFWS issued a new Biological Opinion for relicensing of the Rocky Reach Project (USFWS 2008). In the new Opinion, USFWS issued a new Incidental Take Statement for bull trout for Project Elements, superseding the 2004 take authorizations. Quantitative take levels for bull trout were issued for eight Project Elements of the new Rocky Reach License (Table 3-2). While neither the previous or current incidental take levels for bull trout were exceeded, Chelan PUD will adhere to the new take authorizations through the next 5-Year Biological Objectives reporting period (2014-2018).

### **3.1 Objective: Incidental Take not exceeded - Bull trout Adult Upstream Passage 2005-2008**

#### **Results of Monitoring**

Chelan PUD submits annual reports on Incidental Take of bull trout to the USFWS for the Rocky Reach Project. Chelan PUD submits an annual report called "*Observations of Bull Trout during Implementation of the AFA/HCP, Bull Trout Management Plan and other FERC License Activities for the Rocky Reach Project*" to the USFWS by April 15 each year.

No lethal take has been observed for Rocky Reach Project for authorized activities since 2008. From 2005 to 2008, only two bull trout were captured and released (in 2008) in the Chelan PUD's pikeminnow control programs. No other non-lethal or lethal Take has been

identified. The link below provides an example of the annual report prepared each year for the USFWS to monitor Take:

[http://www.chelanpud.org/departments/licensingCompliance/rr\\_implementation/ResourceDocuments/36840.pdf](http://www.chelanpud.org/departments/licensingCompliance/rr_implementation/ResourceDocuments/36840.pdf)

Chelan PUD continues to report observations of bull trout captured in fishway traps for Rocky Reach HCP work, and by other researchers for activities that are unrelated to the HCP or Chelan PUD activities. WDFW and the Yakama Nation both utilize the traps for research programs and or brood collection. Each has Incidental Take authorization under which they each report Take of bull trout to USFWS annually.

Table 3-1. Authorized Incidental Take levels of bull trout issued by the USFWS for Rocky Reach Project Elements, May 2004 through December 2008.

<b>Project Element</b>	<b>Type of Take</b>	<b>Lethal Take</b>
Turbine Operations	Harm or Harass	5%
Juvenile Fish Bypass	Harm or Harass	2%
Spillway Operations	Harm or Harass	2%
Adult Fishways	Harm or Harass	2%
Predator Control	Harm or Harass	2 fish

Table 3-2. Revised Incidental Take levels for bull trout issued in 2008 by the USFWS for Rocky Reach Project License Elements and the associated quantitative take levels for each element (USFWS 2008).

Project Element	Type of Take	Lethal Take		Non-lethal Take	
		Adult	Juvenile/ Sub-adult	Adult	Juvenile/ Sub-adult
Turbine Operations	Harm or Harass	20	5	57	46
Juvenile Fish Bypass	Harm or Harass	1	3	2	10
Spillway Operations	Harm or Harass	3	1	122	50
Adult Fishways	Harm or Harass	1	2	73	14
Hydrograph Variation	Harm or Harass	1	3	125	48
Predator Control	Harm or Harass	2	1	123	51
Hatchery Supplementation Plans	Harm or Harass	1	12	1198	*
Monitoring Plans	Harm or Harass	3	1	122	50
	<b>Total</b>	<b>32</b>	<b>28</b>	<b>1198</b>	<b>269</b>

From 2005-2009, Chelan PUD examined upstream passage of adult bull trout through fishways at Rocky Reach Dam. For the study, 71 adult bull trout were captured and tagged with radio-tags. Passage of fish was tracked using four radio-telemetry tracking techniques including fixed detection sites within the Rocky Reach Dam (turbine intakes, juvenile fish bypass system, spillway, adult fishway and fishway entrances) boat tracking in the reservoir, and truck and aerial tracking, to monitor incidental take of adult bull trout. Chelan PUD maintained multiple telemetry receivers at the dam and in the Wenatchee and Entiat rivers which operated continuously for 1,496 days during the study. Bull trout passed upstream through Rocky Reach Dam successfully using adult fishways in all study years, and no bull trout perished during upstream passage. During the monitoring period, no take occurred and the Biological Objective for not exceeding Chelan PUD's 2% incidental take allowance (USFWS 2004) was achieved.

Chelan PUD enumerates bull trout passing the Project upstream through fishways by round-the-clock counting using video and hi-definition cameras. Annual fishway passage counts of bull trout are shown in Table 3-3.

In the five-year telemetry monitoring period (2005-2009), a total of 41 upstream passage events by radio-tagged bull trout were observed and evaluated at Rocky Reach. Based on those passage events, the median amount of time tagged bull trout resided within the tailrace of Rocky

Reach Dam was 0.28 days; the median time spent migrating in and out of the fishway was 2.48 days, and the median time spent migrating up the fishway after final entry was 0.25 days (Stevenson et al. 2009). Collectively, the overall median Project migration time from tailrace to exit was 3.84 days. Fish spent relatively little time in the tailrace or within the fishway itself after last detection at the fishway entrance. No mortality was observed during any upstream passage event during the study period. Upstream passage and incidental take of bull trout will be monitored again at Rocky Reach in 2018.

Table 3-3. Monthly and total annual counts of bull trout passing Rocky Reach Dam (fishway window counts) 2005-2013.

Year	April	May	June	July	August	Sept	Oct	Nov	Total
2005	0	69	62	15	0	1	4	4	155
2006	0	58	49	13	1	1	2	7	131
2007	1	30	28	12	2	1	3	0	77
2008	1	21	41	6	6	2	8	15	100
2009	1	15	43	21	1	1	0	1	83
2010	0	24	61	13	8	1	5	12	124
2011	1	26	95	22	11	2	3	8	168
2012	1	40	91	25	14	1	16	31	219
2013	2	78	70	30	1	2	5	1	192

#### Degree of Achievement of Objective

The objective to minimize Incidental Take of adult bull trout and remain with incidental take limits authorized at the Rocky Reach Project for upstream passage has been achieved and is being maintained at Rocky Reach.

#### Recommendations and Management Options Taken

Chelan PUD conducts rigorous, annual off-season fishway maintenance work to insure successful passage for both anadromous fish and resident fish such as bull trout. The RRF has recommended no new or additional options to maintain safe adult passage for bull trout. Any work done to the fishway to enhance passage of adult fish other than bull trout is reviewed by the USFWS to ensure safe passage for bull trout is not compromised.

### **3.2 Objective: Incidental Take - Bull Trout Adult Downstream Migration 2005-2008**

#### Results of Monitoring

During the 2005 to 2009 study period, radio-tagged bull trout made a total of 47 downstream passages at Rocky Reach Dam (Stevenson et al. 2009). Of these downstream passage events by adult fish, 35 downstream passage events occurred through the powerhouse (turbines), two through the spillway, two through the Juvenile Bypass System, and eight through unknown routes, escaping radio-detection. For these 47 passage events observed

over the entire study period, no documented bull trout mortality associated with downstream passage via any route through Rocky Reach Dam was documented (Stevenson et al. 2009). If any radio-tag signal was detected for more than three days in the tailrace within 400 meters of its last detection following a downstream passage, the tag location was pinpointed as close as possible and two scuba-divers were deployed from a boat into the tailrace to assess the status of the fish. During the entire study, two dives occurred. Each time, the tagged fish was alive and not visibly injured, rather, just holding position near the bottom usually near large boulder structure. When approached, the fish exited their positions quickly. No fish mortalities occurred in as a result of downstream passage at Rocky Reach during the study.

Degree of Achievement of Objective

Chelan PUD has achieved the Objective of minimizing Incidental Take and remaining within authorized Take levels for adult downstream passage of bull trout at Rocky Reach. The allowances for incidental take for downstream passage through turbines (5%), spillways (2%), and juvenile bypass (2%) from 2005-2008.

Recommendations and Management Options Taken

Chelan PUD will again assess downstream passage of adult bull trout and monitor Incidental Take of bull trout at the Rocky Reach Project in 2018 using an active tag technology per the USFWS Biological Opinion (2008).

**3.3 Objective: Incidental Take Not Exceeded - Predator Control Programs 2005-2008**

Results of Monitoring

Table 3-4 contains the annual pikeminnow harvest numbers from Rocky Reach Reservoir, 2005 through 2008. Chelan PUD will continue to apply efficient predator control programs in Rocky Reach Reservoir over the next ten years to help ensure that salmonid survival rates achieved for at the Rocky Reach Project (HCP) are maintained.

Table 3-4. Pikeminnow removed from Rocky Reach Reservoir during Chelan PUD’s predator control programs and any associated incidental take of bull trout, 2005-2013.

Year	Pikeminnow Harvested	Bull Trout Take Allowance	Incidental Take	Take Method	Lethal Take?
2005	41,018	2	0	-	No
2006	45,630	2	0	-	No
2007	62177	2	0	-	No
2008	57,475	2	2	Fishway traps	No, released

#### Degree of Achievement of Objective

This Biological Objective has been achieved for the evaluation time frame, 2005 through 2008. Chelan PUD has not exceeded incidental take allowances established by the USFWS for bull trout in Predator Control Program at the Rocky Reach Project. Chelan PUD prepares an annual report to the USFWS which contains the number of bull trout observed during each authorized activity and any fish Incidentally Taken during each activity.

#### Recommendations and Management Options Taken

This Objective has been achieved and maintained. The RRF has not recommended any additional management options be considered for this Objective.

### **3.4 Objective: Incidental Take not exceeded- Sub-Adult Downstream Migration 2005-2008**

#### Results of Monitoring

Quantitative incidental take allowances for sub-adult bull trout moving downstream through the Rocky Reach Project and juvenile fish bypass were established by the USFWS its December 5, 2008 Biological Opinion for re-licensing of the Rocky Reach Project (USFWS 2008). Juvenile bull trout observation rates are very low at the Project. Capture and handling rates of juvenile fish are also very low. Sub-adult bull trout passing downstream of the Project through the turbines or the spillway at the Project are not detectable due to lack of tagging technology and a source of juvenile bull trout for tagging evaluations. However, some juvenile fish are observed in the Juvenile Bypass System anadromous sampling facility. During daily bypass sampling from April through August, 2005 to 2008, Chelan PUD observed only 17 sub-adult bull trout less than 355 mm in length; 14 of these fish were collected in 2008.

Active-tag studies on downstream passage of juvenile bull trout, as was assessed for adult bull trout, have not been feasible and are still not feasible at this time. Juvenile bull trout are not available to tag and study at this time to assess downstream passage at the Project. Chelan PUD PIT tagged bull trout for this measure and continues to monitor the PITAGIS database for re-detection of fish tagged at Rocky Reach and associated hatchery monitoring facilities (smolt traps).

#### Degree of Achievement of Objective

For Rocky Reach Project activities authorized for Take, No lethal take has occurred for passage routes monitored with sampling such the juvenile bypass system and adult fishways. All sub-adult fish observed and or handled were healthy and released in good condition into the tailrace of the Project.

#### Recommendations and Management Options Taken

No additional recommendations been received and no additional management options have been necessary as this Objective has been achieved and maintained.

**3.5 Objective: Incidental Take not exceeded– Sub-Adult Rearing in Reservoir 2005-2008**

Results of Monitoring

In 2007, Chelan PUD compiled Rocky Reach daily reservoir inflow patterns (mainstem inflow plus tributary inflow) and hourly surface elevation data for the reservoir to construct Rocky Reach headwater duration curves (Figures 3-1, 3-2, and 3-3). These dates were used to assess potential for bull trout take as a result of stranding in the reservoir. The data demonstrated that Rocky Reach reservoir elevations are held fairly stable with very little drafting of more than two feet below maximum full pool elevation of 707 feet msl (mean sea level). Three years mean hourly elevations (2005-2007) show that Rocky Reach Reservoir operates within two feet of full pool greater than 90% of all hours.

These data was used in conjunction with field maps of backwater and off-channel areas in Rocky Reach Reservoir to evaluate potential effects of reservoir operations on these areas and whether or not movement of bull trout into, or out of, these areas is affected. Review of radio-telemetry detection data from 2005 and 2006 indicates that bull trout spend much of their time in deeper water habitats, and have not been observed using the limited number of backwater areas in Rocky Reach Reservoir during multiple telemetry surveys. Back water and side channel areas comprise a very small percentage of the total surface area of Rocky Reach Reservoir.

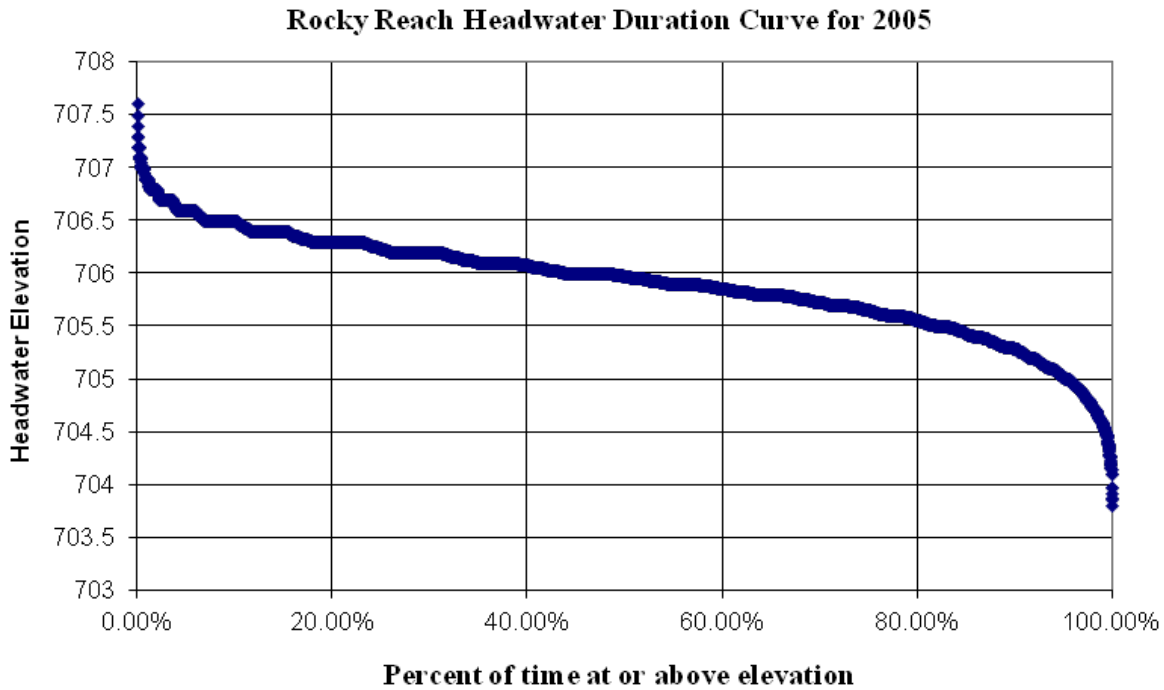


Figure 3-1. Rocky Reach Reservoir headwater duration curve for 2005 showing range of hourly reservoir (forebay) surface elevations and percent of time the reservoir was at or above a given elevation.

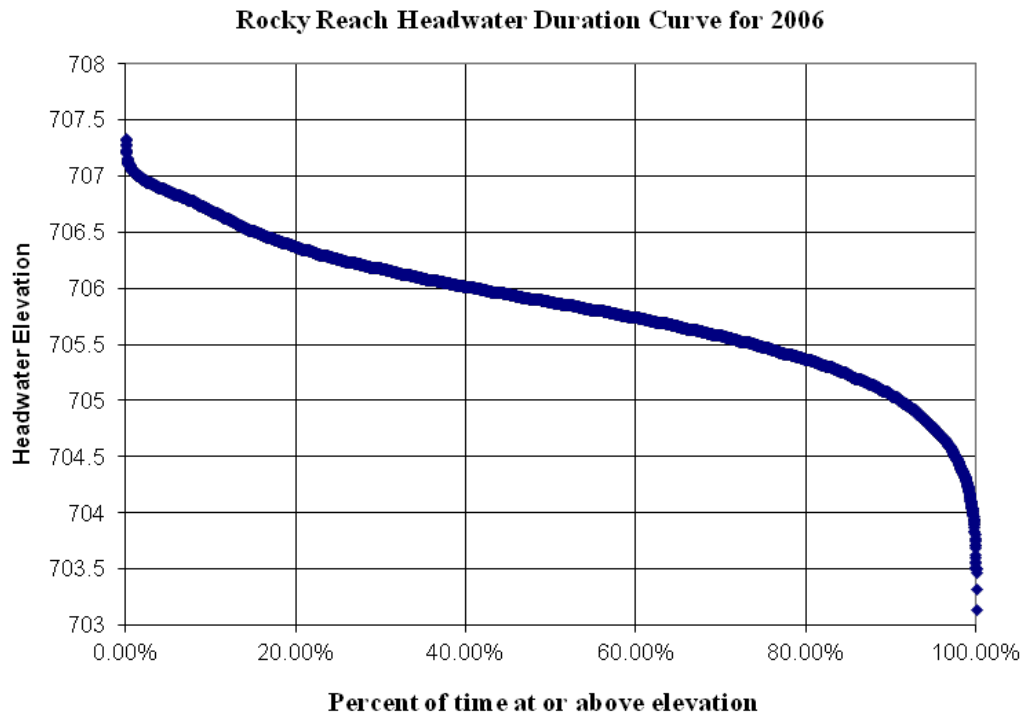


Figure 3-2. Rocky Reach Reservoir headwater elevation duration curve for 2006 operations showing percent of time the reservoir (forebay) was at or above a given surface elevation.



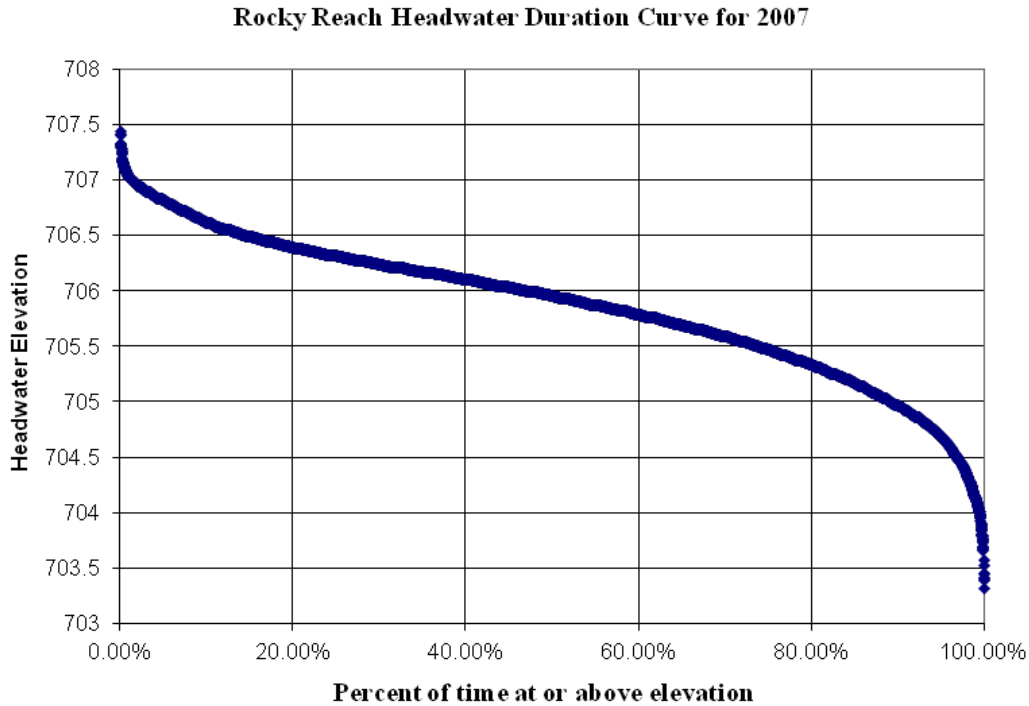


Figure 3-3. Rocky Reach Reservoir headwater duration curve for 2007 showing range of hourly reservoir surface elevations (forebay) and percent of time the reservoir was at or above a given elevation.

*Juvenile Fish Bypass Monitoring*

Juvenile bull trout may enter the Rocky Reach juvenile fish sampling facility during collection of salmon and steelhead for daily species composition and fish condition monitoring. To the extent feasible, Chelan County PUD documents age-group, year-class, length-weight information, and degree and frequency of de-scaling for all juvenile bull trout observed during juvenile anadromous salmonid index sampling at the Juvenile Fish Bypass System. No de-scale or injuries were observed on any of the 17 juvenile bull trout ( $\leq 355$  mm) was observed from 2005-2008 in the bypass system (Chelan PUD 2009).

Each bull trout captured at the sampling facility from 2005-2008 was tagged with a passive integrated transponder (PIT) tag and monitored for recapture of those tags in the adult fishway and the juvenile bypass system at Rocky Reach via the PIT tag detections systems installed at each location. No bull trout tags were re-detected in the fishway from 2005 through 2008.

Monitoring and additional PIT tagging of juvenile bull trout will take place for a one-year period, beginning in year 10 of the New License and continuing (2018) every 10 years thereafter, upon recommendation of the RRFF, to continue implementing appropriate and reasonable methods for monitoring sub-adult bull trout at Rocky Reach Dam. Specifically, Chelan PUD

may continue to provide PIT tags and equipment, and facilitate training, to enable fish sampling entities to PIT tag sub-adult bull trout when these fish are collected incidentally during fish sampling operations at Rocky Reach fish facilities.

Degree of Achievement of Objective

The RRF, including USFWS, have agreed that it is not yet feasible (no active tag available and small numbers of juvenile fish) to fully assess sub-adult bull trout Incidental Take during upstream and downstream passage at the Project (Bull Trout Management Plan, 4.2.2) (Chelan PUD 2004), nor is it feasible to assess direct effects on survival from Project-related operations during rearing in the reservoir. As a run-of-river project (meaning daily inflow is approximately equal to daily outflow), stranding of any juvenile fish is not likely to occur because the reservoir does not undergo deep, rapid drafting.

Recommendations and Management Options Taken

No recommendations have been made by the RRF and no additional management options have been taken for monitoring at this time. No lethal or non-lethal Incidental Take of sub-adult bull trout has been observed in Rocky Reach Reservoir.

## ***SECTION 4: WHITE STURGEON***

### ***Goal***

The overall goal of this Rocky Reach White Sturgeon Management Plan (WSMP) is to promote white sturgeon population growth in the Reservoir to a level commensurate with the available habitat based on monitoring results. This is to be accomplished by meeting the following objectives: 1) increasing the population of white sturgeon in the Reservoir through implementing a supplementation program to a level commensurate with available habitat and allowing for appropriate and reasonable harvest; 2) determining the effectiveness of the supplementation program; 3) determining the carrying capacity of available habitat in the Reservoir; and 4) determining natural reproduction potential in the Reservoir, and then adjusting the supplementation program accordingly.

### ***4.1 Objective: White Sturgeon Natural Reproduction Potential***

#### Results of Monitoring

To date, Chelan PUD has captured several white sturgeon adults and although spawning has not been identified, these fish are being tracked and monitored for their location to determine natural reproduction potential. The white sturgeon population in the Reservoir was estimated to be within a range of 50 to 115 fish, with a 95-percent confidence estimate that the population is between 23 to 698 fish (Golder, 2003a). While the accuracy of this estimate is very uncertain, comparisons with other reservoir-based populations in the middle Columbia River suggest it is unlikely that the population is greater than 300 fish. Few reproductively mature adult fish may exist in the reservoir.

While the assessment of natural white sturgeon reproduction potential is required in five annual surveys between years 8 through 18 of the new License (WSMP), Chelan PUD initiated this work by utilizing acoustic receivers deployed to monitor juvenile sturgeon movements during the initial three-year index monitoring program to jointly collect data on adult sturgeon in the reservoir. Data compiled leading up to year eight of the License will be used to guide suitable locations and times to conduct spawning ground surveys of adult sturgeon to achieve this Biological Objective. Chelan PUD plans to increase the sample size through further acoustic tagging of any adult sturgeon that may be encountered and, with the tags currently implanted in adult sturgeon expected to be active until June of 2023, Chelan PUD expects to have a population of tagged adult sturgeon ready to track to identify potential spawning locations in years 8-10 (2016-2018) and year 13 (2021) of the License.

Chelan PUD has deployed remote acoustic telemetry receivers throughout the Rocky Reach reservoir to monitor both juvenile and adult white sturgeon tagged with Vemco acoustic tags (Table 4-1). During data download of receivers in late June of 2013, seven adult sturgeon

ranging in total length from 6.3 to 7.1 feet were captured on set lines and tagged with long-life (10-year) acoustic tags. All adult tagged fish were released as close as possible to their point of capture in the reservoir, with all captures occurring between the Wells and airport receiver locations.

Table 4-1. Acoustic Telemetry Receiver Locations in the Rocky Reach Reservoir.

<b>Receiver Location</b>	<b>River Kilometer</b>
Wells Tailrace 1	826.8
Wells Tailrace 2	826.7
Airport 1	819.0
Airport 2	817.8
Beebe Bridge 1	811.2
Beebe Bridge 2	811.1
Duck Tail Rock 1	794.0
Duck Tail Rock 2	793.8
Entiat 1	780.7
Entiat 2	780.7
Rocky Reach Boat Restriction Zone 1	762.9
Rocky Reach Boat Restriction Zone 2	762.9
Rocky Reach Tailrace 1	761.8
Rocky Reach Tailrace 2	761.2
Rocky Reach Tailrace 3	761.2

All tagged adult fish were tracked throughout the remainder of 2013. Four fish showed slight downstream movements from their release location during the summer, with all four fish being last detected on the Airport 2 receiver. The remaining three fish exhibited further downstream movements. By August 2013, all three fish had migrated to the Entiat receivers. One fish continued to move downstream to the boat restriction zone receivers, but returned to the Entiat receiver by September 2013, where all three fish were last detected in 2013 (C. Wright, personal communication). Early tracking data from acoustic tagged fish in each year’s release (2011-2013) group shows similar behavior with more fish detected in the upper end of the reservoir. Trends in 2013 were similar to other years with 60% of the tagged fish found above the most upstream release location.

Degree of Achievement of Objective

Additional time is required to achieve this Objective, since juvenile white sturgeon supplemented into the reservoir may not mature and become reproductively viable for 12 to 18 years. Achievement of this Objective is expected to occur in years 8 through 10 of the new Rocky Reach License period.

### Recommendations and Management Options Taken

Chelan PUD will continue to capture and acoustic-tag additional adult white sturgeon when they are encountered to assist with monitoring and evaluation of potential white sturgeon spawning and spawning locations within the reservoir.

### **4.2 Objective: Increase the White Sturgeon Population in the Reservoir through Supplementation Commensurate with Habitat Carrying Capacity**

#### Results of Monitoring

The White Sturgeon Subcommittee is comprised of Chelan and Grant PUDs, as well as the Co-Managers (Yakama Nation and WDFW) developed a recommended path forward for brood year 2010 that was presented to the RRFF on January 28, 2010 and approved on February 25, 2010 which stated a preference of obtaining broodstock from Mid-Columbia reservoirs (Priest, Wanapum, or McNary pools) (RRFF 2010a). Brood collection efforts in the Mid-Columbia resulted in a 1x2 parental cross. Due to 2010 brood collection efforts falling short of the 6x6 target, the RRFF approved the release of 6,500 juveniles made up of 2,600 fish from the 1 female x 2 male cross, and an additional 3,900 fish from a 3 female x 2 male captive brood cross collected by the Yakama Nation. Juveniles were reared at both Marion Drain (Yakama Nation facility) and Chelan Hatchery until April 2011 when 6,376 fish were released at river kilometer 816.7 in the Rocky Reach Reservoir. All juveniles released were scute marked and PIT tagged. Forty two fish were also implanted with acoustic tags.

Through collaborations with the Co-Managers and Chelan PUD, the 2011 White Sturgeon Hatchery Plan was presented to the RRFF on May 4, 2011 (RRFF 2011a). The document served as a summary of the 2010 Mid-Columbia Sturgeon Technical Workgroup, and outlined activities agreed to by the Co-Managers including description of acceptable locations of brood collection and the required effort, a minimal target spawning matrix, and steps to be taken by the Co-Managers should brood collection efforts fall short of the minimum spawning matrix to be targeted, all with a collaborative regional approach in mind (RRFF 2011b).

Broodstock collection efforts were focused in the tailrace of the Dalles Dam with augmentation from Grant PUD in the Wanapum Reservoir and additional effort from the Dalles Dam tailrace from Chelan PUD. This combined work resulted in a 1 female x 1 male cross whose progeny was raised at Yakama Nation's Marion Drain facility, and Chelan PUD's Chelan Falls Hatchery. The RRFF determined that due to the low number of parental crosses achieved, stocking should be limited to 1,000 individuals (RRFF 2012a). Unfortunately, due to the confirmation of infections of White Sturgeon Iridovirus (WSIV) and complications causing fish to exhibit a hyper-inflated swim bladder from an unknown etiology, only 147 juveniles were stocked in May 2012 at river kilometer 816.7. All juveniles released were scute marked and PIT

tagged. Ten individuals were also implanted with acoustic tags. An additional 25 tags were implanted in recaptured fish from brood year 2010 encountered during the 2012 Northern Pikeminnow Removal Program (Wright and Robichaud 2013).

A path forward for brood year 2012 was developed in collaboration with the Co-Managers and Chelan and Grant PUDs (RRFF 2012b). Broodstock collection efforts were expanded to the tailraces of McNary (Chelan PUD) and the Dalles (Yakama Nation), as well as the Wanapum reservoir (Grant PUD), resulting in a 3 female x 1 male cross and an additional 1 female x 4 male cross. All spawning activities were carried out at Marion Drain. In addition to rearing fish at Marion Drain, fertilized eggs were also transported to Columbia Basin and Chelan Hatcheries for grow out purposes in an effort to protect against previous fish health issues experienced in 2012 (RRFF 2012c). Juvenile sturgeon at all three hatchery facilities were tested and determined to be free of disease and pathogens. In an effort to boost fish numbers in the Rocky Reach pool ahead of the monitoring and indexing effort in 2013, the RRFF agreed to stock approximately 1,100 juveniles over the upper limit of 6,500 fish stated in the WSMP (RRFF 2013a). In May of 2013, 7,979 fish from Columbia Basin and Chelan hatcheries were released into the Rocky Reach Pool, spread equally over three release locations at river kilometers 816.7, 784.5, and 778.9. All released individuals were PIT tagged and scute marked, with 65 fish being implanted with an additional acoustic tag in an effort to evaluate habitat usage lower in the reservoir during the 2013 monitoring and evaluation effort (Wright and Robichaud 2013).

In total, 14,502 juveniles have been stocked into the reservoir since 2011 (Table 4-2). Although juveniles were released across the initial stocking timeframe outlined in the WSMP, the RRFF recognized the health issues that compromised fish scheduled for release in 2012 and agreed to extend the initial stocking period of the WSMP an additional year, allowing a juvenile release of up to 6,500 fish in 2014 (RRFF 2013b). Brood collection was similar to 2012, with an increased effort in the McNary tailrace by Chelan PUD from one week to two weeks. Broodstock collection yielded a 3 female x 3 male cross, plus an additional 1 female x 3 male cross. Fertilized eggs were once again delivered to Columbia Basin and Chelan Hatcheries, and discussion is currently on-going in the RRFF as to the appropriate number of juveniles to stock in 2014.

Table 4-2. Number of juvenile White Sturgeon stocked into Rocky Reach Reservoir, 2011-13.

<b>Year</b>	<b>Juveniles Stocked</b>	<b>Release Location (River km)</b>
2011	6,376	816.7
2012	147	816.7
2013	7,979	816.7, 784.5, 778.9
<b>Total</b>	<b>14,502</b>	

The modified stocking timeline also altered the schedule for monitoring and evaluating stocked juveniles. Indexing was scheduled to start after stocking in 2012, but, since the modified stocking schedule resulted in decreased sample size, the first year of indexing was moved to 2013. However, in 2012 the bi-catch data from the northern pikeminnow removal program were analyzed. A total of 98 juvenile sturgeon were recaptured, with all recaptures occurring in the upper three kilometers of the reservoir (river km 825.6-829.6) (Wright and Robichaud 2013).

The first indexing and monitoring study directly targeting sturgeon was conducted from August to October 2013. Fish from each year's release, 2011-2013, were recaptured. The combination of both a random and selective survey approach was used in an effort to collect data on survival, growth, habitat usage, age structure, and emigration from fish released throughout the reservoir. Early data analysis continues to show high use of habitat in the upper end of the reservoir, with roughly 60% of the fish released in 2013 moving up above the highest release location (river km 816.7). Acoustic data were analyzed and PTAGIS was mined for downstream detections of marked fish, producing a weighted average emigration rate of approximately 4.8%. The 2013 monitoring and indexing report is currently being compiled and will be available to the RRF in March 2013 (Wright, personal communication).

#### Degree of Achievement of Objective

Through juvenile stocking and index and monitoring studies, Chelan PUD is currently working to meet the supplementation and carrying capacity Biological Objective. Supplementation is occurring, but the M&E program is in its infancy and as expected, has not had adequate time in the first 5-year reporting period to determine what the potential white sturgeon carrying capacity is for Rocky Reach Reservoir.

#### Recommendations and Management Options Taken

The RRF has recommended that the Monitoring and Evaluation should continue. A white sturgeon subgroup is working to design an M&E program that can identify carrying capacity through time and guide stocking levels each year up to 6,500 juveniles.

The white sturgeon population has been increased through supplementation and the analysis of habitat use and survival is currently in its first year and ongoing. The final year of initial juvenile stocking will occur in 2014 and will be followed by the second year of index and monitoring and annual stocking thereafter. Results will be added to the ongoing database to further analyze both current and previous releases of juveniles. The third year of index monitoring is planned for 2015, followed on a cycle of every three years thereafter. Ongoing analysis of the database will be used to provide data to the RRF to aid in determination of stocking levels beyond the initial stocking period outlined in the WSMP. While adult broodstock collection has not been fully predictable, Chelan PUD will continue to collaborate with the Co-Managers and the RRF to identify proper sources of adult brood and release

strategies as well as the exploration of other possible options such as larval collection to meet future stocking goals. Chelan PUD funded contractors from 2010 through 2013 to collect adult brood, and spawn, and rear juvenile White sturgeon. The cost of these efforts to date was \$495,374.

#### **4.3 Objective: Success in Creating Population with Stable Age-Structure Allowing Limited Harvest**

##### Results of Monitoring

With the releases scheduled for 2014, there will be four different age classes of juveniles residing in the Rocky Reach Reservoir. The data to be collected from initial index and monitoring studies (2013-2015) is expected to meet the study objectives: determine survival rates; abundance; density; condition factor; growth rates; identify distribution and habitat selection of juvenile sturgeon, and determine carrying capacity. The capture and tagging of additional adult sturgeon is intended to increase knowledge of the existing population structure of older cohorts, which will help determine the current age-structure of the population.

As of 2014, the Objective of “success in creating a population with a stable age-structure that allows for limited harvest” will have three cohort groups of young juveniles (approximately 19,500 individuals), which may provide harvest opportunity in the future as these fish reach maturity. Estimated age and residency times are shown in Table 4-3.

Table 4-3. Estimated age and residency time of juvenile white sturgeon stocked into Rocky Reach Reservoir from 2011 through 2014.

<b>Release Date</b>	<b>Approximate Age<sup>1</sup></b>	<b>Approx. Residency Time<sup>2</sup></b>
April 2011	51 Months	40 Months
May 2012	39 months	27 Months
May 2013	27 Months	15 Months
May 2014 (estimated release date)	15 Months	3 Months

<sup>1</sup>Juvenile white sturgeon are approximately 1 year old at release.

<sup>2</sup>Residency times are based on proposed sampling during year two of index and monitoring in August 2014

##### Degree of Achievement of Objective

The evaluation timeframe for attaining this Biological Objective is stated in the 401 Water Quality Certification, Table C, as years 20 through 50 of the WSMP. Chelan PUD is on schedule for achievement of this Objective. Chelan PUD, in collaboration with the Co-Managers and the RRRFF, has released 14,502 juvenile white sturgeon into the Rocky Reach Reservoir from 2011 to 2013. Releases have been in excess of 6,000 fish each year with the exception of 2012, when fish health concerns restricted the release to 147 juveniles (Table 4-2). Release strategies have structured the hatchery origin sturgeon population in Rocky Reach reservoir with three different age classes of juveniles. Once stocking is complete (with the fish scheduled to be released in 2014), the index and monitoring effort scheduled for August 2014 will collect data



from fish ranging in residency time from 3 months to 40 months and across 4 different age classes (Table 4-3).

Recommendations and Management Options Taken

The RRFF has recommended continued annual stocking of juvenile sturgeon into Rocky Reach Reservoir and continued monitoring of behavior and movement of tagged fish for the M&E program. Collaboration will continue between the Co-Managers, the RRFF, and Chelan PUD to collect brood (or larvae) and continue supplementation of juveniles to ensure multiple age classes are present by year 20 of the WSMP and beyond. Data from index and monitoring studies should be analyzed to identify possible changes to hatchery practices and juvenile condition factors that may provide an increase to post-release survival. Chelan PUD in consultation with the RRFF will continue to refine release strategies to achieve good survival and distribution of juveniles in the reservoir commensurate with available habitat and carrying capacity. Successful incorporation of new information and adaptive management is expected to meet the Objective of creating a population with a stable age-class structure that allows for limited harvest.

## ***SECTION 5: PACIFIC LAMPREY***

### ***Goal***

The goal of the PLMP is to provide safe, timely, and effective passage for adult and juvenile Pacific lamprey; and where unavoidable Project impacts are measured, then provide appropriate and reasonable Protection, Mitigation, and Enhancement measures (PMEs) that achieve an overall No Net Impact (NNI) on this population. Objectives to achieve this goal include addressing: 1) potential ongoing Project impacts on upstream passage of adult Pacific lamprey; 2) potential ongoing Project impacts on downstream passage of juvenile Pacific lamprey; 3) potential ongoing Project impacts on the existing reservoir habitat used currently by juvenile Pacific lamprey; and 4) any unavoidable impacts by identifying and implementing measures to achieve No Net Impact (NNI).

### ***5.1 Adult Upstream Passage Success***

#### ***Results of Monitoring***

The Biological Objective for the Rocky Reach Project associated with upstream passage of adult Pacific lamprey through fishways at Rocky Reach Dam is to achieve a passage rate that is similar to the best rates at other mainstem hydroelectric projects on the Snake and Columbia rivers. Two years of monitoring tagged lamprey has occurred, and at least one additional year of monitoring ladder passage improvement is needed to determine the next steps, or confirm whether or not this Biological Objective is achieved or not achieved. The number of additional years of ladder passage monitoring to achieve this Objective is not known at this time. Additionally, passage monitoring at other mainstem hydroelectric projects is ongoing to assess comparable passage rates for comparison to Rocky Reach. No Project on the Snake or Columbia rivers has yet to report completion of ladder passage monitoring or establishment of metrics for adult lamprey passage efficiency. This Biological Objective is therefore still in progress at Rocky Reach.

In 2005, Chelan PUD conducted a relicensing study to evaluate adult Pacific Lamprey passage at Rocky Reach Dam using radio tagged adults (Stevenson et al. 2005). This analysis provided the basis to identify passage issues for adult lamprey in the fishway and guide the scope of future work and improvements necessary to improve passage.

In 2010, Chelan PUD conducted a literature review, *Pacific Lamprey Upstream Passage Modifications Literature Review and Analysis and Recommendations for Passage Improvements in the Rocky Reach Fishway* (Le and Nass 2010) to determine what modifications should be made within the fishway to improve lamprey passage. On October 28, 2010 Chelan PUD presented the RRFF with engineering plans and proposal to construct modifications to components of the adult fishway (RRFF 2010b). On December 6, 2010, Chelan PUD filed the

design drawings for approval with FERC to make these modifications to adult fishway to improve adult lamprey passage.

After approval from FERC and review and approval of designs by the RRFF in October 2010 (RRFF 2010b), Chelan PUD began extensive work that was completed in two phases in the Rocky Reach adult fishway in 2011 and 2012. The work included rounding and smoothing of edges on fishway entrance structures, and fabrication and installation of aluminum ramps and plates to enable passage over gratings through orifices. Ramps were constructed and placed at perched orifices in the upper fishway. Plating was installed along fishway walls and over the diffusion grating in the bifurcation pool and left powerhouse fishway entrance to reduce fallback and increase overall passage. The second phase was completed early in 2012 which installed plating at all weir orifices in the lower fishway. The total cost of these improvements was \$102,000.

In 2011, Chelan PUD in consultation with the RRFF installed a half-duplex (HD) PIT tag detection system within the fishway at Rocky Reach at a cost of \$176,000 to monitor improvements in lamprey passage as a result of fishway modifications. The HD PIT detection system is composed of HD antennas installed at seven different locations within the fishway and at fishway entrances (Chelan PUD 2013; Anders and Lee 2011) (Table 5-2, Figure 5-1). This system is able to detect adult lampreys PIT tagged downstream at Bonneville and other Federal Columbia Power System (FCRPS) dams, with same fish providing passage data for multiple Columbia River Projects.

Adult lampreys were tagged with HD PIT tags by the Army Corps of Engineers and University of Idaho researchers at Bonneville Dam in 2012 and 2013. Lampreys migrating from that location to the mid-Columbia were monitored at Rocky Reach Dam in the same years (Chelan PUD 2013). Chelan PUD conducted bi-weekly checks of all detection equipment at Rocky Reach and downloaded PIT data from the seven detection sites a total of 142 times each year.

From July through October 2012, 11 adult lampreys were detected and monitored in the fishway at Rocky Reach, with eight of the 11 fish passing upstream (72.7%) by the time monitoring ended in December with fishway maintenance (Table 5-2). From July through October 2013, 13 PIT tagged adult Pacific lampreys were detected at Rocky Reach Dam, with (Table 5-3) with six of the 13 lamprey passing by the end of the monitoring period in December. In 2013, the first and earliest detection occurred on July 30, while the last fish of the season was first detected on October 3. Six of the 13 fish (46.2%) are assumed to have passed Rocky Reach as these fish were last detected at the last fishway antenna (RRH 07) with no subsequent detections afterward. No fish detected at Rocky Reach in 2012 were detected in 2013, and no fish detected at Rock Island Dam in 2012 were detected in 2013 at Rocky Reach.

Table 5-1. HD PIT tag antenna sites and descriptions of antenna locations at entrances and within the Rocky Reach adult fishway.

<b>HD Detection Site</b>	<b>Antenna Site Description</b>	<b>Number of Antennas</b>
RRH(01)	Entrance, Left Powerhouse (LPE)	1
RRH(02)	Entrance, Main Spillway (MSE)	2
RRH(05)	Entrance, Right Powerhouse (RPE)	2
RRH(03)	Internal, trifurcation pool	2
RRH(04)	Internal, transportation channel	2
RRH(06)	Internal, beginning of pool and weir ladder	2
RRH(07)	Most upstream antenna before exit of fishway to forebay	2

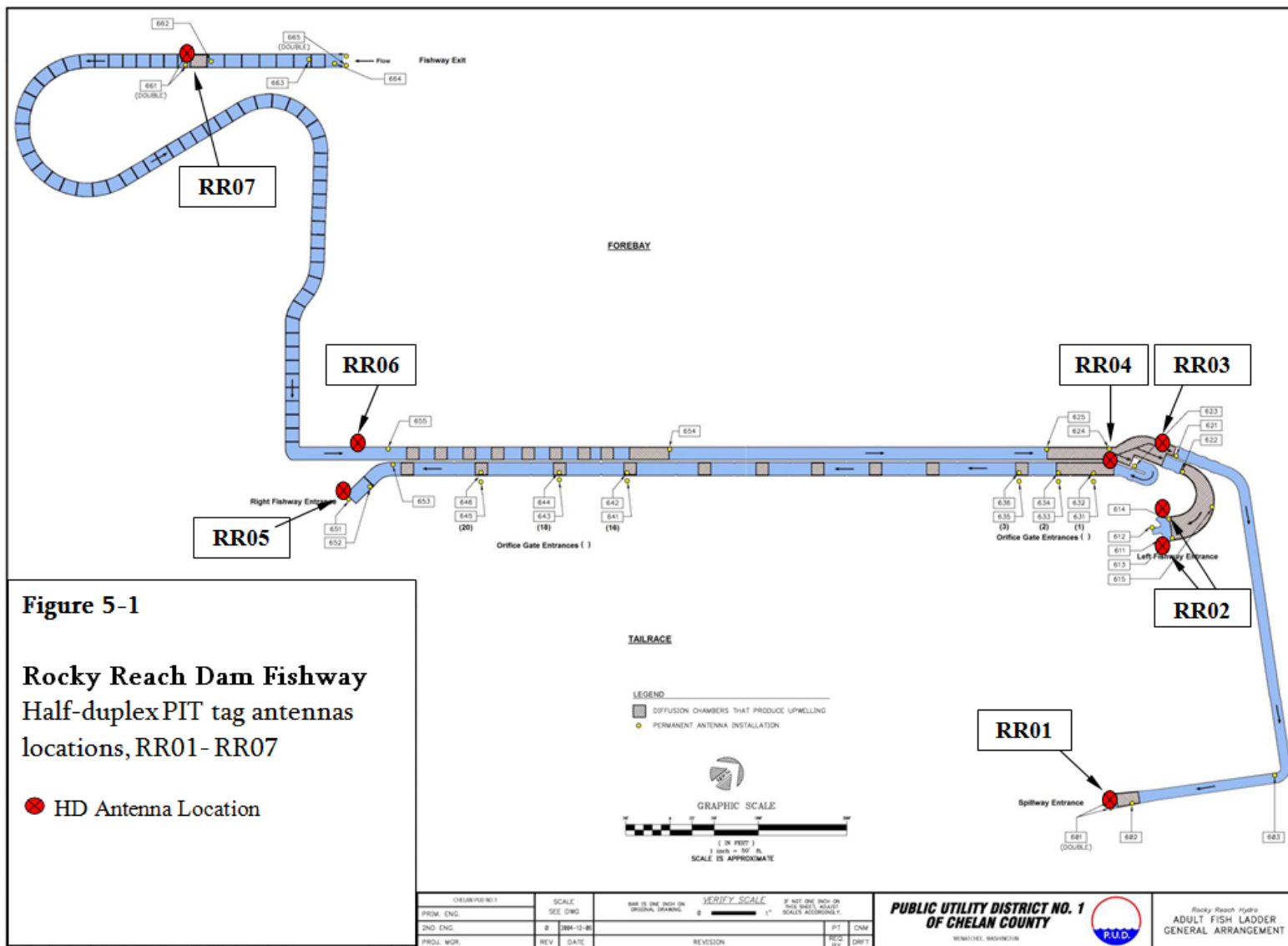


Figure 5-1. Rocky Reach dam fishway half-duplex PIT tag antennas locations, RR01-RR07.

Table 5-2. HD PIT tag detections of adult Pacific lamprey at Rocky Reach in 2012.

HD Tag Code	First Detect Date	First Detect Location	First Detect Time	Last Detect Date	Last Detect Location	Last Detect Time	Date Passed?
8FC08C8	9 Sept	RR (02)	22:01	10 Sept	RR(07)	22:17	10 Sept
9E9065B	16 Sept	RR (05)	20:22	16 Sept	RR(07)	3:04	17 Sept
A306F3C	14 Oct	RR(02)	20:44	15 Oct	RR(06)	21:54	unknown
A306F44	2 Sept	RR(01)	21:00	5 Sept	RR(07)	22:55	5 Sept
A326DE5	28 Jul	RR(03)	2:47	28 July	RR(07)	7:43	28 July
AB79DCA	2 Sept	RR(02)	20:56	5 Sept	RR(07)	22:55	5 Sept
AB79E47	25 Aug	RR(03)	4:29	25 Aug	RR(07)	9:45	25 Aug
AB79F0D	15 Sept	RR(03)	20:15	18 Sept	RR(07)	2:42	18 Sept
AB79F41	13 Oct	RR(02)	0:56	15 Oct	RR(06)	0:01	unknown
AB7A02B	1 Oct	RR(06)	5:02	1 Oct	RR(06)	5:02	unknown
AB7A03F	14 Sept	RR(02)	18:55	15 Sept	RR(07)	4:16	15 Sept

Table 5-3. HD PIT tag detections of adult Pacific lamprey at Rocky Reach Dam in 2013.

HD Tag Code	First Detect Date	First Detect Location	First Detect Time	Last Detect Date	Last Detect Location	Last Detect Time	Date Passed?
A326D65	30 July	RR(07)	3:23:25	30 July	RR(07)	3:55:37	30 July
AECBEFC	6 Aug	RR(03)	20:37:00	7 Aug	RR(07)	0:43:08	7 Aug
AECC5BB	15 Aug	RR(07)	4:12:43	15 Aug	RR(07)	4:12:56	15 Aug
AECC355	19 Aug	RR(02)	23:02:46	20 Aug	RR(07)	4:50:30	20 Aug
AECC36F	20 Aug	RR(03)	2:40:32	20 Aug	RR(07)	7:17:22	20 Aug
AEBB9B5	31 Aug	RR(06)	21:35:20	1 Sept	RR(07)	1:01:08	1 Sept
AEBB952	7 Sept	RR(01)	23:22:30	7 Sept	RR(01)	23:22:30	Unknown
AEBB9E1	15 Sept	RR(01)	21:41:29	12 Dec	RR(03)	20:37:35	Unknown
AECBEC0	11 Sept	RR(01)	1:53:46	11 Sept	RR(01)	1:53:46	Unknown
AEBB942	22 Sept	RR(02)	23:19:47	9-Nov	RR(06)	0:33:16	Unknown
AECBF0A	22 Sept	RR(06)	23:16:00	23 Sept	RR(03)	0:44:36	Unknown
ABAC50E	25 Sept	RR(06)	22:04:49	26 Sept	RR(04)	3:08:05	Unknown
AECC3AF	3 Oct	RR(07)	5:29:03	27 Oct	RR(04)	22:27:05	Unknown

Upstream passage rates for adult Pacific lamprey are being evaluated currently at other mainstem Snake and Columbia River hydroelectric projects by their respective operators using HD PIT tag monitoring. These evaluations are not yet completed at any project and Chelan PUD

is unaware of any passage efficiency conclusions to draw on for comparison. Additionally, more year(s) of monitoring at Rocky Reach are needed to complete this Biological Objective.

Chelan PUD has compiled historical upstream fishway counts (window counts) at Rock Island Dam and Rocky Reach Dam to assess minimum adult conversion rates between the two Projects (Figure 5-2). The unadjusted conversion rate shown in Figure 5-2 is the number of adult lamprey counted passing Rocky Reach Dam annually divided by the number of adults counted passing Rock Island Dam in the same passage year. The conversion rates shown in Figure 5-2 are not adjusted for possible fall back and subsequent recount of the same fish (would bias the conversion rate positive), and are not adjusted for an unknown number of adults that escape to the Wenatchee River to spawn (would bias the conversion rate negatively). However, the conversion rate analysis is useful to evaluate overall passage rate success of unmarked adult lamprey through time for Rocky Reach, and depicts an increasing positive conversion passage rate trend from the top of Rock Island Dam to the top of Rocky Reach Dam.

In 2013, 1,625 adult Pacific lampreys were counted passing Rocky Reach Dam and 2,155 adults were counted passing Rock Island Dam. This is an unadjusted conversion rate of 75.4% between the two Projects. The overall trend line in conversion rates between Rock Island and Rocky Reach has a positive slope. The slope of conversion rates would not appear positive if adult lamprey passage through the Rocky Reach fishway was poor and not increasing on an annually basis.

Adult lamprey passage counts at Rocky Reach Dam are shown in Table 5-4. The RRF has discussed funding HD PIT tag detection system installation in tributaries (Wenatchee River and Entiat River) to determine tributary escapement, and aid in determining overall passage success and the whereabouts of adults after they pass Rocky Reach (RRFF 2013d).

Table 5-4. Adult Pacific lamprey fishway passage counts at Rocky Reach Dam by month, 2008-2013.

Year	May	June	July	August	September	October	November	Total
2008	0	0	11	161	188	8	0	368
2009	0	1	13	155	105	4	0	278
2010	0	0	6	126	110	26	0	268
2011	0	0	0	85	482	51	0	618
2012	0	0	5	251	496	53	0	805
2013	0	0	37	577	1,000	11	0	1,625

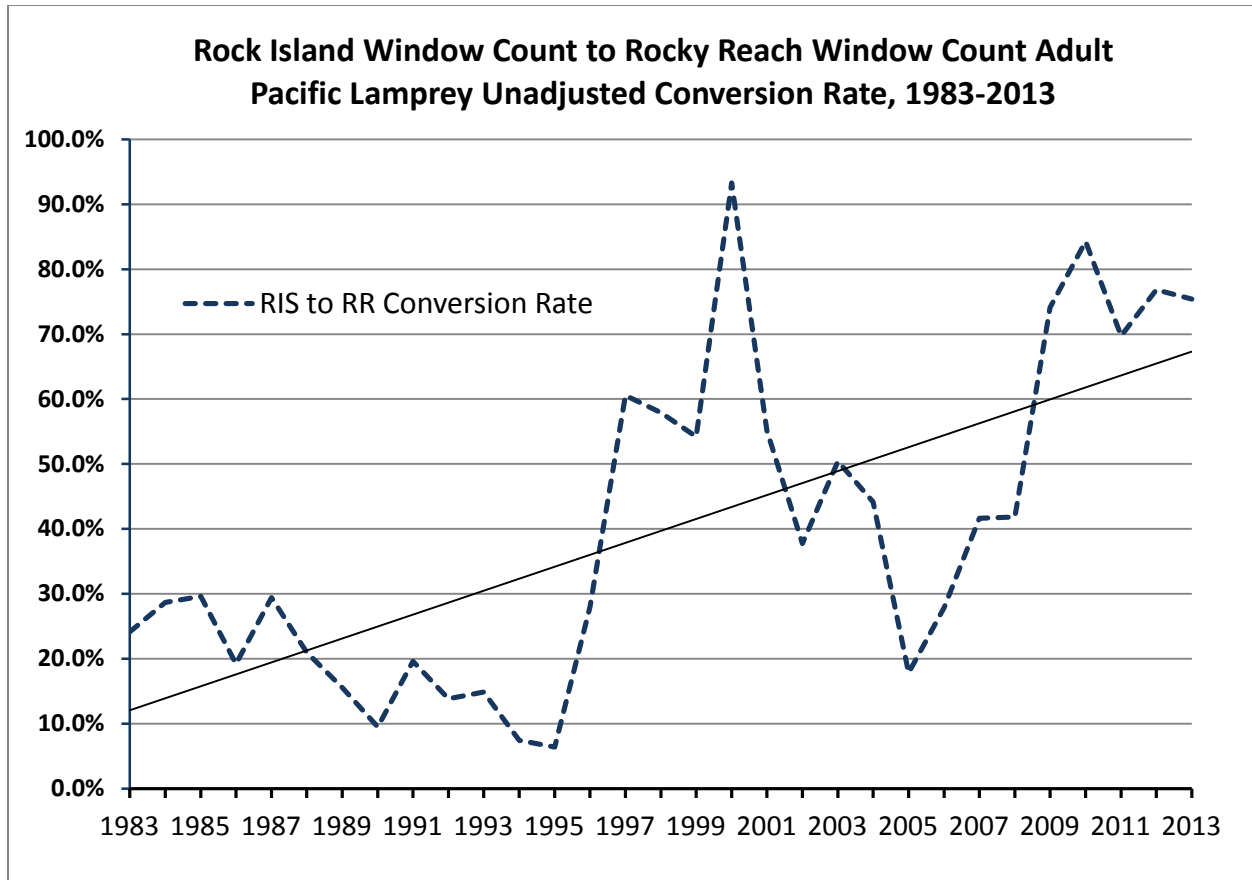


Figure 5-2. Unadjusted window count conversion rates of adult Pacific lamprey passing Rock Island Dam and then Rocky Reach Dam from 1983 to 2013.

Degree of Achievement of Objective

The Objective of adult lamprey upstream passage success is ongoing and has not been fully achieved during the first five years of the license. Evaluation of ladder modifications made for Pacific lamprey in the Rocky Reach fishway is ongoing. Passage rate efficiency metrics at Rocky Reach have not been established by the RRFF as yet for comparison to Rock Island Dam.

Recommendations and Management Options Taken

The RRFF is currently discussing several additional recommendations and management option to allow more rapid evaluation of the adult upstream fishway modifications at Rocky Reach and feasible methods to evaluate reservoir passage. These options include 1) increasing the sample size of half-duplex PIT tagged adult lamprey to enable data gathering from more fish ascending the Rocky Reach fishway; 2) annually translocating several hundred adult fish from the lower Columbia River up to the Rocky Reach Project in order to conduct an active-tag study of dam passage success and reservoir passage behavior; and 3) modifying current full-duplex PIT tag antenna arrays that already exist in the Wenatchee and Entiat rivers to include half-duplex PIT detection capabilities so that tagged lamprey passing Rocky Reach can also be



detected in tributaries to provide known whereabouts of individual fish. These options are still being discussed and analyzed by the RRF. No additional options were selected within the first 5-year reporting period but continued progress on this objective is expected to be made in the next reporting period.

***Objective 5.2: Juvenile Lamprey - Maintain safe, effective, and timely volitional passage criteria (as defined by the RRF)***

**Result of Monitoring**

The Rocky Reach Pacific Lamprey Management Plan (PLMP) requirement in section 4.2.1 is to operate the Rocky Reach Juvenile Bypass System (JFB) in accordance with operations for anadromous salmonids and compatible with bull trout migration per the HCP and Rocky Reach Fish Passage Plan. Chelan PUD operates downstream juvenile passage facilities to maintain safe and volitional passage of juvenile lamprey.

Chelan PUD constructed the Rocky Reach juvenile bypass system to guide juvenile salmon and steelhead away from turbine intakes at Rocky Reach Dam. The system consists of one surface collector entrance (SC) and the intake screen (IS) system in turbine units 1 and 2. Please refer to Mosey et al. (2004) for a detailed description of the bypass production system.

The JFB is operated from April 1 through August 31 each year. Juvenile fish sampling at the Juvenile Sampling Facility (JSF) in 2013 occurred throughout the operating period, Monday through Sunday. Sampling is conducted on the hour for a maximum of 30 minutes from 0800 hours through 1130 hours. The target number of juvenile salmonids to be collected is 350 spring species and 125 summer species. Fish sampled are examined for run timing, fish condition, species composition, and origin of fish stocks and identification of marked (PIT tag; fin clip) individuals.

Each juvenile lamprey collected during sampling is measured for length, examined for fish condition and injury, categorized as migratory (eyes present) or non-migratory (eyes absent), and returned to the river.

Around the clock sampling was conducted from late April through early June at the JSF in 2009 through 2011 in conjunction with implementing survival studies for juvenile spring Chinook salmon. The intent of the increased sampling was to document diel migration of juvenile spring Chinook salmon in order to validate survival study assumptions. Additionally, diel migration data was collected for other spring migrants, such as steelhead, sockeye salmon, and juvenile lampreys.

Data from 2011 show a very strong peak juvenile lamprey passage at Rocky Reach in mid-May (Table 5-5). The vast majority of juvenile observed during the peak migration in 2011

were collected during nighttime hours: from 2200 hours to 0400 hours. A similar trend was observed in 2009 and 2010 although total numbers of juvenile lampreys were considerably lower than 2011. Few juvenile lampreys have been observed in samples collected outside the dates shown in Table 5-5 for years 2009 through 2013. The reduced number of juvenile lampreys observed in 2012 and 2013 is likely a result of reduced sampling times in those years.

Columbia River turbidity data were collected during May 2011. Turbidity (NTU) values from May 1 through May 15, 2011 ranged from 7.5 to 9.0 NTU from May 1 through May 15. Turbidity increased significantly on May 16, with a daily value of 4 NTU, dropped to 2.4 NTU on May 17, and remained between 3.5 and 4.7 NTU for the remainder of the month. During this period there was not a corresponding increase in mainstem Columbia River flow until May 18. Several theories were discussed by Chelan PUD staff regarding the dramatic increase in juvenile lamprey passage and increased turbidity. One hypothesis is that individual juvenile lamprey undergoing metamorphosis into macrophthalmia migrate actively during nocturnal hours and possibly during periods of increased water turbidity, using low light and or reduced water clarity (increased turbidity) as a cue to initiate downstream migration. Another hypothesis is that higher flow events in tributaries potentially scour juvenile lamprey from rearing areas and forcibly move them downstream, resulting in increased numbers of juveniles observed at the Rocky Reach fish bypass system. These are possible explanations, but not known with any certainty at this time at the Rocky Reach Project.

Table 5-5. Juvenile Lamprey Counts at the Rocky Reach Juvenile Sampling Facility, 2009-2013.

DATE	2009		2010		2011		2012		2013	
	Migratory	Non-Migr	Migratory	Non-Migr	Migratory	Non-Migr	Migratory	Non-Migr	Migratory	Non-Migr
27-Apr			9							
28-Apr			3	1						
29-Apr	2				1	1				
30-Apr		1	2			1			1	
1-May			1							
2-May						1				
3-May						1				
4-May					1	1				
7-May						1			1	
8-May										
9-May	1				1	1				
10-May	1					2				
13-May		1	2							
14-May					1					
15-May		1								
16-May					266	77				
17-May					349	262				
18-May	1		1	1	9	94				
19-May			2		1	7				
20-May						2				
21-May	1	1	5			2				1
22-May			7			2				
23-May			7			1				
24-May			3	2	1	3				
25-May			1			5				
26-May						4				
27-May					1	11				
28-May						6				
29-May				1		5				
30-May			1	1		3				
31-May		1	1	1		5				
1-Jun						1				
2-Jun		1	1			3				
3-Jun			3	1						
4-Jun			5	3						

Section 4.2.2 of the PLMP requires that “During the juvenile lamprey passage period, Chelan PUD shall continue to monitor potential lamprey impingement on turbine intake screens to assure impingement rates remain negligible until such time as the RRFF recommends that monitoring is no longer necessary.”

Juvenile lamprey impingement monitoring was conducted at Rocky Reach Dam in 2006 and 2010 (Chelan PUD 2010), and again in 2013 (Chelan PUD 2013). Although 2006 data were not collected during the timeframe of this Biological Objectives Status Report (2009-2013), the data provided information to the RRFF upon which the Forum made decisions regarding incidence of juvenile lamprey impingement and screen monitoring frequency.

Fish counters reviewed Unit C1 and C2 diversion screen cleaning operations for 23 days in 2006:

- 3 cleanings in April
- 4 cleanings in May
- 6 cleanings in June
- 7 cleanings in July
- 3 cleanings in August

During the 23 days, counters observed six possible juvenile lampreys on the screens: 5 in April and 1 in August. Four lampreys were reported for C1 and C2 screens combined (i.e. when screens in both units were cleaned in one night) and two were reported for C1 screen cleanings only.

Fish counters reviewed C1 and C2 diversion screen cleaning operations for three days in the 2010 monitoring period, April 15 through June 15. No juvenile lampreys were observed during any cleaning operations conducted on May 18, June 5, and June 22 on either C1 or C2 diversion screens.

The Rocky Reach Fish Forum reported from their their February 2, 2011 meeting that that conducting and reporting annually on juvenile lamprey impingement monitoring under USFWS prescription Article 5(b)(2) would no longer be necessary. However, they will have a bi-annual review to evaluate the necessity to reinstate the monitoring and reporting” (RRFF 2011a).

During the 2013 screen-monitoring period for juvenile lamprey (mid-May through mid-June), the screens in both units, C1 and C2, were cleaned a total of seven times (13 May, 17 May, 23 May, 28 May, 31 May, 7 June, and 14 June). The total video footage time for the seven cleaning events in 2013 was 15 hours, 45 minutes. Chelan PUD fisheries biologists reviewed the

video recording of these cleaning events. No juvenile lampreys were confirmed to be impinged on screens. For the entire period, only two individual “shapes” were reported as possible juvenile lamprey, but determination was inconclusive and described by the reviewing biologist as 50/50 at best.

The RRFF approved bi-annual monitoring of Rocky Reach Unit 1 and 2 turbine intake screens. At this time the RRFF has requested no further action other than bi-annual monitoring of the screens. The next monitoring year will be spring 2015 at Rocky Reach. The Biological Objective of monitoring volitional downstream passage has not been evaluated, primarily due to lack of mark- recapture technology for juvenile lamprey.

Section 4.2.3 of the PLMP requires that “Between years two and five of the New License, Chelan PUD shall continue to measure the type and magnitude of any ongoing Project impacts on the downstream passage of juvenile lamprey using appropriate and reasonable methodologies. Specifically, these methodologies will address juvenile lamprey downstream migration timing and passage survival through the Project.” Also, “...Chelan PUD shall, in consultation with the RRFF, develop means to provide sufficient numbers of juvenile lamprey for these evaluations. Chelan PUD, in consultation with the RRFF, may choose to contribute to other local or regional lamprey investigation programs in order to gain efficiencies in the development of methods for lamprey investigations at the Project.”

Laboratory studies have been conducted by researchers to begin to investigate the type of effects that turbine passage that may cause on downstream migrating juvenile lampreys in the Columbia and Snake rivers by studying effects of barotrauma (rapid pressure changes). Juvenile lamprey have been used as test fish in studies attempting to simulate passage conditions that juvenile lampreys may experience passing hydroelectric projects during their downstream migration. These studies involved introducing juvenile lampreys to high concentrations of total dissolved gas (TDG), which is produced by high spill levels at dams, and conditions that could occur during passage through turbines, such as blade strike, sudden changes in barometric pressure (baro-trauma), and shear stress near turbine blades and in draft tubes. The RRFF developed a draft Juvenile Lamprey Survival at Rocky Reach Dam Effects Analysis (RRFF 2012c) to identify potential sources of mortality, potential effects, the level of concern for each by RRFF parties, and possible corrective actions specific to Rocky Reach Dam for effects of concern.

Although no absolute conclusions were agreed to or acted upon by the RRFF from this exercise, some excerpts from available research data used in the effects analysis are:

Total dissolved gas: Brief exposure to shallow depth is not sufficient to develop emboli. Juvenile lampreys generally reside below compensation depth. (Colotelo et al. 2012).

Turbine blade strike: Tests conducted for strike from turbine blades of varying thicknesses with American eels, approximately 300 mm in length, showed survival rates of 100 percent for most test conditions (Amaral, et al. 2008).

Turbine pressure: Limited effects have been observed on juvenile lampreys physical condition, immediate or delayed, and no observed behavioral response of juvenile lampreys to instantaneous pressure drop when applied (Colotelo et al. 2012).

Turbine shear stress: Shear force of 90 cm/sec per cm was applied, which is much higher than applicable to turbine passage. No immediate or delayed effect on survival of treatment juvenile lampreys was observed (Mueller 2012).

The RRFF has not reached consensus on the effects analysis, and significant discussions continue at present regarding the type and magnitude of ongoing Project effects, corrective actions, data needs, and area and level of responsibility.

The RRFF conducted several efforts to investigate the ability to produce test fish for survival studies or additional methods that could measure the type and magnitude of any ongoing Project impacts on the downstream passage of juvenile lamprey. The RRFF commissioned preparation of the report: *Pacific Lamprey Artificial Propagation and Rearing Investigations: Rocky Reach Pacific Lamprey Management Plan report* (GeoEngineers et al. 2011). The goal of the document was to “provide guidance as to the feasibility of culturing Pacific lamprey, assess types of associated facilities necessary for culture practices, and identify uncertainties for monitoring culture efficacy and rational for implementing Pacific lamprey artificial propagation.” With the “ultimate goal” of the PLMP to achieve No Net Impact (NNI) to Pacific lamprey with regard to ongoing operations of the Rocky Reach Hydroelectric Project, the RRFF went forward to conduct the study on potentials for artificial propagation of Pacific lamprey which is considered by the state and federal fishery agencies and Tribes as a potential Protection, Mitigation, and Enhancement measure (PME) for achieving NNI during the term of the Rocky Reach License.

The document focused on three aspects: 1) develop an artificial propagation manual; 2) research potential structured rearing facilities; and 3) research potential riverine rearing facilities.

#### *Juvenile Lamprey Artificial Propagation Manual*

The Manual for the Intensive Culture of Pacific Lamprey was developed by the U.S. Fish and Wildlife Service (Ostrand et al. 2011). The manual demonstrates that culture of Pacific lamprey is definitely possible, from adult collection, spawning, fertilization, and early rearing to larval stage. At that time, however, it was reported in the manual that Pacific lamprey

propagation “has not been done intensively (where all life-stages are reared under controlled culture conditions) on a production scale or from gametes to reproductively mature adults.” The manual also identified “significant difficulties for intensive culture because of the long duration of the juvenile period that requires a food supply for anywhere from four to seven years while they are ammocoetes (Beamish 1987; Wydoski and Whitney 2003) and the maintenance of food sources for the parasitic life history form.” Other articles corroborate the uncertainty and longevity of the juvenile rearing phase of Pacific lamprey life history (Pletcher 1963; Kan 1975; Richards 1980; Beamish and Northcote 1989). However, the specific length of larvae life of Pacific lamprey is mostly unknown because of inconsistent length frequency data and the lack of bony structures (Close et al. 1995).

The challenge of artificial propagation of Pacific lamprey was highlighted in the manual by the statement “Developing a methodology for the culture of Pacific lampreys through all life history stages will take several years to achieve, and challenges will be encountered with each life history stage until they are successfully raised to adults.” The Yakama Nation, one Party to the RFFF, has stated that it is not the intent of artificial propagation to culture fish to the adult phase.

Additionally, the manual described Pacific lamprey life stages and major bottlenecks to successful culture. The manual also includes sections on Macrophthalmia Rearing/Maintenance/Release, Parasitic Pacific Lamprey Maintenance, and Disease and Treatment. Yakama Nation researchers have noted that they are currently propagating “large numbers of juvenile lamprey at one of their existing facilities. However the RFFF has not received any report on this progress.

One conclusion included in the manual was that it was the first attempt to summarize culture methodologies for rearing all life stages of Pacific lamprey and needs further actions to refine and test culture methods. Additional conclusions were that little is known about the intensive culture of lampreys, most work has been conducted on an experimental basis, and that development of effective and efficient techniques will likely involve the collective efforts of fisheries researchers, fish culturists, and nutritionists. Final recommendations provided in the manual are in the form of research needs to address critical uncertainties and suggestions for future research and evaluation.

### *Structured Rearing Facilities*

Existing state, federal, Tribal, and research hatchery facilities in Washington and Oregon were evaluated for potential Pacific lamprey rearing sites. A questionnaire was developed specific to the needs of a basic lamprey aquaculture facility and sent to the managers and leaders of regional facilities. The focus was on facilities in the vicinity of the Rocky Reach Project near

the Wenatchee, Entiat, and Methow drainages. Eleven facilities were identified, based on questionnaire results, and evaluated for hatchery staff experience and interest in lamprey culture, adult holding facilities, incubation and hatching facilities, available rearing space, water quality and quantity, ability to heat or cool water, ability to isolate lamprey culture from salmonids culture facilities, and water source pathogens and contaminants. Of these 11 facilities, 7 were recommended in the report as centers with capability and interest in Pacific lamprey propagation.

#### *Riverine Rearing Facilities*

This section of the report “discusses rearing facilities that may be appropriate for propagation of juvenile lamprey in the study area. The purpose of this inventory is to identify natural riverine sites within the study area watersheds (Methow, Chelan, Entiat and Wenatchee) that have high potential value to support the goals of the Pacific lamprey Artificial Propagation Project by providing rearing sites for artificially propagated juvenile Pacific lamprey.” Identified in the report are riverine facilities within each watershed that may be suitable for rearing juvenile lamprey. The report also provided monitoring recommendations that could be implemented to evaluate the potential effectiveness sites identified for achieving program goals.

Potential sites were evaluated throughout the Methow, Chelan, Entiat and Wenatchee watersheds. The Okanogan watershed was considered initially, but was eliminated due to time and budgetary constraints and the desire of the RRFF to one “untreated” watershed for potential comparison to “treated” watersheds. Draft criteria for potential lamprey propagation site selection included: 1) ability to recover macrophthmia; 2) land ownership/accessibility; 3) vehicle accessibility; 4) suitable thermal, flow regimes, substrate; 5) oxbow/high-flow side channel; 6) associated downstream habitat; 7) implications of attracting adult lamprey to area; and 8) predation risk. Following is the number of sites in each watershed recommended in the report, based upon the selection criteria, as having the highest habitat value/potential needed for Pacific lamprey release sites: Methow – 2; Chelan – 1; Entiat – 2; and Wenatchee – 3.

A primary conclusion offered in the report is that initial observations indicate that rearing within “riverine facilities” would not be as beneficial as rearing within “structural facilities”. Although the concept is viable, environmental factors and predation are not controllable. Within structural rearing facilities it becomes easier to manage environmental factors such as temperature and water quality while completely removing predation factors.

#### Degree of Achievement of Objective

The overall Objective of safe timely juvenile Pacific lamprey downstream migration through the Rocky Reach Project has not been fully achieved in the first 5-year license period. Downstream passage studies were not feasible, and still are not feasible, primarily due to lack of juvenile tagging methods, and existence and availability of an active tag to mark and detect



juveniles for studies. Tag technology for juvenile lampreys is necessary to measure the type and magnitude of possible effects on downstream passage through the Project. Currently, tag technology is being developed for juvenile lamprey, but to date, commercial availability of tags and the required bio- testing have not been completed. These processes have unknown completion dates at this time.

#### Recommendations and Management Options Taken

To evaluate the potential to produce juveniles for study, the RRFF commissioned the preparation of the report: Pacific Lamprey (*Lampetra tridentata*) Breeding and Rearing Methodologies - Recommendations for Chelan County PUD (Wade and Beamish 2012). This report was intended to investigate the potential for providing test fish for juvenile survival studies or to implement other measures to achieve NNI. The objectives of the investigation were to:

1. Evaluate specific growth rates, health, and survival of Pacific lamprey reared at various densities to determine space requirements and vessel designs for culture of various life history stages, particularly ammocoetes; and
2. Identify and develop foods, rations, and feeding methods for optimal juvenile pacific lamprey growth and nutrition.

Information from previous work conducted by Dr. Richard Beamish was compiled and summarized to address both stated objectives, and a literature search was provided to enable decision-makers to determine the best course of action for capture and culture of Pacific lamprey as a component of fulfilling section 4.2.3 Measurement of Impacts on Juvenile Downstream Passage of the PLMP. A very important caveat stated early in the report was that “Dr. Beamish’s experience with breeding and culture of lamprey was varied, but in no way was it a commercial scale breeding program; it was for experimental purposes and focused on providing accurate identification of ammocoetes.”

The report provided information from Dr. Beamish’s experience involving adult capture, culture methods and rearing conditions, transport, broodstock, spawning, egg incubation, rearing ammocoetes, and culture considerations for the artificial propagation of lamprey.

Wade and Beamish (2012) recommended releasing larval young-of-the-year ammocoetes into the wild to supplement natural populations. They suggested also that some cultured lamprey could be held for a year under experimental conditions, but that it may not be possible to raise large numbers of ammocoetes through to metamorphosis, when they could be used as test fish, in captivity due to the time and space required and potential for significant mortality during that time. The report identified that some type of tagging technology is a necessary evaluation component for assessing the efficacy of any supplementation program.

Recommendations in the report were primarily in the form of additional research needs, such as securing pathogen-free water source, holding wild broodstock, identifying appropriate rearing densities, disease treatments, and developing protocols for evaluating program efficacy. One recommendation re-emphasized the suggested strategy of releasing larval ammocoetes versus holding ammocoetes to metamorphosis stage.

The report concluded that the fertilizing and rearing of eggs from Pacific lamprey is not a significant obstacle. If very large numbers of eggs are incubated, typical of large Pacific salmon hatcheries, it would be necessary to develop protocols similar to those used in large production hatcheries. To date, no researcher has attempted to incubate large numbers of eggs nor have protocols or attempts been made to rear large numbers of juveniles to the migratory life-stage. Recently the Yakama Nation and the CTUIR Tribes have conducted work to collect and spawn adults, and are currently rearing significant numbers of ammocoetes at various tribal facilities.

Considerations in Designing Juvenile Lamprey Survival Studies were presented at the Juvenile Pacific Lamprey Seminar held August 1, 2012 (Skalski 2012). The presentation addressed study design considerations, tag considerations, model assumptions and design options for tagging studies, strengths and weaknesses of design options, potential useful preliminary studies, and appropriate sample size calculations.

Skalski (2012) reported that if PIT-tags were used for a juvenile lamprey survival evaluation, then a large sample size (7,000 to 18,000 fish) would be required in order to achieve the appropriate precision for a survival estimate. Acquiring this number of true migrating macrophthalmia that exhibit 100 percent migratory behavior (tagged fish cannot stop, delay migration or overwinter) makes the ability to conduct survival studies prohibitive at the current time. Additional analyses showed that if active tags (i.e. acoustic tags) were available and used, then a much smaller sample size (709 to 2076 fish) would be required in order to achieve the appropriate precision of the survival estimate (Skalski and Townsend 2013). However, to date such a tag does not exist that is small enough with sufficient battery life to conduct a survival study. Additionally, Skalski (2012) presented that with either tag technology, a methodology for conducting an unbiased survival study with test fish that may not actively migrate does not exist. Study methods used for salmonid survival studies would be invalid if rearing behavior caused some tagged juvenile lamprey (test fish) to stop their active downstream migration through the study area after release. Active migration of test fish through the study area is critical in paired-release mark-recapture survival studies to achieve unbiased survival study results (Burnham et al. 1987).

Prior to any commercial availability of an acoustic tag for juvenile lamprey, we note that PNNL has planned significant and rigorous pilot testing to ensure no tag effects are observed on

juvenile lamprey health, physiology, behavior, and swimming ability before these tags are used to estimate any hydro passage survival. It is not known at this time whether juvenile lampreys will accept this tag with no physical or behavioral effects that could bias estimates of passage survival through hydropower systems.

The Federal Government put forward a “Sources Sought” solicitation to find a company who could design, engineer, and test a lamprey acoustic tag. A link to this solicitation is provided below. The solicitation was issued May 10, 2013:

<https://www.fbo.gov/index?s=opportunity&mode=form&id=1e2c1b468b541efde874903d0b3d06d4&tab=core&tabmode=list&=>

Although research is ongoing to develop a tag, it is possible that any proof tested, commercially available technology produced for juvenile lamprey passage studies is much further away than 2-3 years away.

Progress has been made from 2009 to 2013 toward collecting information and conducting investigations to measure the type and magnitude of any ongoing Rocky Reach Project effects on the downstream passage of juvenile lamprey. However, because juvenile downstream passage studies using active tags is not currently feasible, discussion is occurring and will continue to occur in the foreseeable future within the RRFF as to management options for modified implementation of objectives, and monitoring and/or evaluation measures that the RRFF will implement to achieve this Biological Objective. For example, the role of artificial propagation and production of larval Pacific lamprey is unclear at this time and is being discussed at RRFF meetings. Also not resolved but being discussed within the RRFF are potential Project effects on adult passage specifically through the Rocky Reach Reservoir and the level of mitigation responsibility of Chelan PUD to address Project impacts and achieve NNI. These issues are expected to come to some level of agreement within the RRFF during the next 5-year reporting period thus supporting regional coordination and implementation efforts focused on addressing the challenges unique to Pacific lamprey life history and migration.

The RRFF continues to discuss juvenile downstream passage evaluations but recognizes the limitations on feasibility to study juveniles with active tags and study methods at this time.

### **5.2 Objective: Avoid and minimize Projects impacts on rearing habitat**

#### Results of Monitoring

The RRFF commissioned the first field work to evaluate the distribution, composition, and abundance of juvenile lamprey (*Lampetra* sp.) within the observed operating range of Rocky Reach Reservoir. A 2011 study report was prepared for the RRFF to review (Chelan PUD 2012). The intent of the report was to address the following objectives:

1. Assess frequency, magnitude, and duration of Rocky Reach Reservoir fluctuations.
2. Identify shoreline shallow water habitat that is consistent with desired juvenile lamprey habitat that may be dewatered by ongoing Project operations.
3. Document presence of juvenile lamprey within and adjacent to habitat.
4. Determine potential effects of Project operations on juvenile lamprey.

Existing aquatic habitat within the Rocky Reach Reservoir with juvenile lamprey rearing characteristics was identified using aerial photographs, bathymetry, shoreline slope, velocity, and substrate characteristics to segregate habitat types into those areas with high (Type 1), medium (Type 2), and low (Type 3) potential for use by juvenile lamprey. The magnitude, frequency, and duration of reservoir elevations in reference to habitats identified were assessed in order to identify potential sampling locations.

Juvenile lamprey presence was assessed using an ABP-2 backpack electrofisher in shallow, wade-able areas that may be affected by Project operations as well as deeper areas that likely remain watered during normal Project operations. Sampling areas were selected based on lamprey habitat types categorized by Hansen et al. (2003). Type 1 is the preferred habitat for juvenile lamprey and consists of sand, fine organic material, detritus, and/or aquatic vegetation. Type 2 habitat is suitable for juvenile lamprey and consists of shifting sand or gravel with little fine organic material. Type 3 habitat is composed of bedrock or hardpan clay along with larger gravel and is unsuitable for juvenile lamprey.

Juvenile lamprey sampling was conducted at sampling sites identified in Figure 5-1. Details of juvenile lamprey sampling locations, sampling duration, and time of day are shown in Table 5-6.

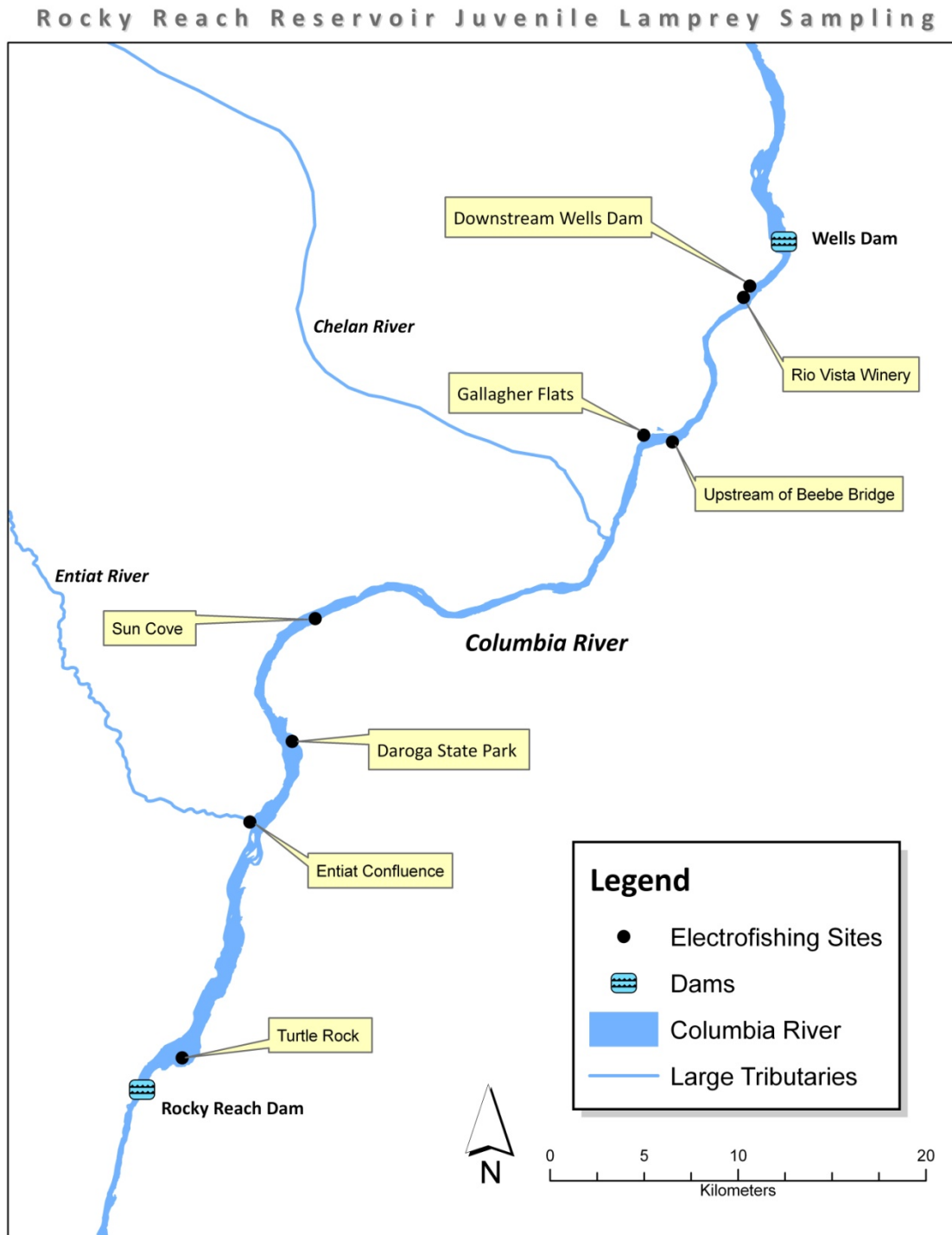


Figure 5-3. Juvenile lamprey electrofishing sampling locations in Rocky Reach Reservoir.

Table 5-6. Juvenile Pacific lamprey electrofishing sampling locations in Rocky Reach Reservoir, including date, sampling effort, and time of day.

Site Name	Sampling Date	Latitude	Longitude	Electrofishing Time	Time of Day
Turtle Rock (east side)	18 Nov	47.54682971	-120.2655617	10 min, 45 sec.	8:45
Entiat Confluence	18 Nov	47.66098251	-120.2243807	13 min.	9:30
Daroga State Park	18 Nov	47.70040801	-120.1967424	11 min, 42 sec.	10:01
Sun Cove	18 Nov	47.7595498	-120.1838521	11 min, 45 sec.	10:30
Gallagher Flats	18 Nov	47.8533302	-119.9555106	12 min, 58 sec.	11:59
Rio Vista Winery	18 Nov	47.9209587	-119.8880906	8 min, 10 sec.	12:15
Downstream of Wells Dam	18 Nov	47.9264806	-119.8839092	11 min, 49 sec.	12:30
Upstream of Beebe Bridge	18 Nov	47.8505602	-119.9348802	10 min, 15 sec.	13:30

Substrate was generally Type 1 habitat in all areas sampled. Substrate at the Daroga Park site exhibited more gravel/cobble composition close to shore, with Type 1 habitat more prevalent in water deeper than could be electrofished effectively. Substrate at the site upstream of Beebe Bridge was comprised of fine sand, but also contained large growths of aquatic vegetation.

Juvenile lampreys were captured only at the Sun Cove site. Five juvenile lampreys were captured, anesthetized, measured for total length, allowed to recover, and released at the location of capture. Lengths of the five juvenile lampreys were: 113 mm, 115 mm, 120 mm, 138 mm, and 142 mm.

Discussion of the study objectives is as follows:

1. Assess frequency, magnitude, and duration of Rocky Reach Reservoir fluctuations.

Assessment of Rocky Reach Reservoir fluctuations was conducted during the Bull Trout Stranding Investigation conducted in 2005, 2006, and 2007, and reported in 2008 (Chelan PUD 2008). Headwater elevations were compiled to create headwater duration curves that were then used to identify shallow-water habitat that may be dewatered on a regular basis. Headwater duration curves demonstrated little reservoir habitat was subject to dewatering due to very stable conditions provided by the operation of Rocky Reach.

Rocky Reach hourly mean, median, maximum and minimum reservoir elevations are summarized in Table 5-7 for years 2005 through 2008. Full reservoir elevation is 707 ft above mean sea level (msl). Licensed minimum is 703 ft msl. Rocky Reach mean annual hourly (8,760 hours) reservoir elevations each year from 2005 through 2008 were, 705.91, 705.86, 705.87, and 705.85 ft msl, respectively. Median hourly elevations were 705.97, 705.88, 705.96, and 705.86

ft msl, respectively. The lowest Rocky Reach hourly elevation (ft msl) recorded each year was 703.80, 703.14, 703.32, and 703.65, respectively. These data, along with headwater duration curves, demonstrate that the elevation of Rocky Reach Reservoir is consistently stable, varying on average only 1.1 feet below maximum full pool elevation. Sampling stations were established in shallow-water habitat areas identified with the potential for dewatering and containing typical juvenile lamprey substrate size.

1. Identify shoreline shallow-water habitat that is consistent with desired juvenile lamprey habitat that may be dewatered by ongoing Project operations.

Table 5-7. Rocky Reach Reservoir annual hourly (8,760 hours) forebay elevation levels in feet above mean sea level (msl), 2005-2008. Full pool elevation at Rocky Reach is 707.0 feet msl.

<b>Year</b>	<b>Mean</b>	<b>Median</b>	<b>Max</b>	<b>Min</b>
2005	705.91	705.97	707.0	703.80
2006	705.86	705.88	707.0	703.14
2007	705.87	705.96	707.0	703.32
2008	705.85	705.86	707.0	703.65

Shoreline shallow-water habitat (Type 1) preferred by juvenile lamprey was identified in the Rocky Reach Reservoir by reviewing aerial photographs, the Rocky Reach Aquatic Habitat Mapping Study Report (DES 2001), and by conducting a boat survey of the reservoir for suitable sampling locations in November 2011.

2. Document presence of juvenile lamprey within and adjacent to habitat.

Juvenile lamprey captured at the Sun Cove site were found along the outside edge of a fairly steep drop-off, at depths of approximately 0.61 m to about 1.2 m deep, on the upstream side of a point. No juveniles were captured further toward the inner part of the bay inside the point in shallower water. Substrate was comprised primarily of fine sand, but also contained a considerable amount of leaf litter, more so than any other sample site. The size of the juveniles indicated that they were older year classes, and the larger specimens may be approaching the size of metamorphosis from ammocoetes to macrophthalmia.

3. Determine potential effects of Project operations on juvenile lamprey.

The sampling crew believed that the location at which the juveniles were collected was deeper than the lowest point of reservoir fluctuation, thus protecting the juveniles from becoming

dewatered or stranded. If true, then the sampling conducted in 2011 indicates that juvenile lamprey were not present within suitable habitat within the area of reservoir fluctuations.

To evaluate Rocky Reach Reservoir hydraulic characteristics to identify potential adverse effects of reservoir operations on juvenile lamprey rearing and migration, in 2013 Chelan PUD calculated full content, mean monthly water residence times and flow-through water velocities [http://www.chelanpud.org/documents/39605\\_Rocky\\_Reach\\_Residence\\_Time\\_Velocity.pdf](http://www.chelanpud.org/documents/39605_Rocky_Reach_Residence_Time_Velocity.pdf) for the reservoir. River flow data for Rocky Reach reservoir were evaluated for years 2001-2012. Mean monthly (January-December) reservoir water retention times ranged between 1.25 to 3.01 days; average monthly water velocities ranged between 0.88 to 2.27 feet per second (Chelan PUD 2012). Based on these data, the RRFF determined that the strongly riverine-like flow conditions that dominate the reservoir were not likely to be a significant limiting factor on juvenile lamprey rearing or migrating (RRFF 2012b). The RRFF has not requested any additional juvenile lamprey reservoir habitat sampling to date. Additionally, the RRFF has requested no further actions to address potential effects of ongoing reservoir operations on juvenile lamprey reservoir rearing or migrating habitat. The RRFF indicated in its effects analysis that while reservoir operations did not appear to be affecting juvenile lamprey rearing or migrating conditions, future sampling or other investigation may be directed by the RRFF in the next five year period.

#### Degree of Achievement of Objective

The Biological Objective to avoid and minimize Project impacts on rearing habitat is being achieved and maintained. The Rocky Reach Project minimizes negative reservoir effects because Rocky Reach Reservoir is a run of river reservoir and is maintained by Chelan PUD with no large vertical drafts and relatively stable day to day elevations. Modifying reservoir operations to further minimize any remaining effects would require major changes at Rocky Reach and to the entire Mid-Columbia River Hourly Coordinated power operations.

#### Recommendations and Management Options Taken

Although not discussed in detail, the RRFF has suggested conducting additional reservoir sampling investigation to detect juvenile presence and areas of use at some time in the future. The RRFF may decide to utilize funding earmarked in the license for downstream passage studies for such evaluations sometime in the next 5-year reporting period.

### **5.3 Objective: No Net Impact**

#### Results of Monitoring

No direct on-the-ground monitoring information is available for the NNI Objective itself. This Objective is the overall achievement of No Net Impact (NNI) for Pacific lamprey within the Rocky Reach Project. Successful achievement of the NNI Objective requires that other associated Biological Objectives for Pacific Lamprey be achieved first, and it is therefore a



compilation of multiple objectives for Pacific Lamprey that have not yet been fully achieved in the first 5-year reporting period.

Section 4.4 of the PLMP requires Chelan PUD to identify and implement measures to address unavoidable impacts to achieve NNI. Progress has been made in the first five years to implement the PLMP and its objectives, as directed by the RRFF, to complete the 10 requirements of the PLMP. The framework of objectives to ultimately achieve NNI for Pacific Lamprey and address the objectives for the Protection, Mitigation, and Enhancement Measures are as follows:

- Objective 1: Measure any ongoing Project impacts on upstream and downstream passage of adult Pacific lamprey, and eliminate those impacts to the extent appropriate and reasonable;
- Objective 2: Measure any ongoing Project impacts on downstream passage of juvenile Pacific lamprey, and eliminate those impacts to the extent appropriate and reasonable;
- Objective 3: Measure any ongoing Project impacts on the existing reservoir habitat used currently by juvenile Pacific lamprey, and eliminate those impacts to the extent appropriate and reasonable; and
- Objective 4: Identify and implement appropriate and reasonable measures to address unavoidable impacts to achieve NNI.

Specifically, section 4.4 on the PLMP requires Chelan PUD to “collect and compile information regarding Pacific lamprey distribution, population status and trends, and juvenile downstream migration timing, to identify and implement appropriate and reasonable measures in order to achieve NNI.” Additionally, “Chelan PUD shall, in consultation with the RRFF, identify and implement appropriate and reasonable measures to address unavoidable losses at the Project in order to achieve NNI. The PLMP states “Chelan PUD... [m]ay consider implementation of off-site actions in order to address unavoidable impacts.”

#### Degree of Achievement of Objective

The No Net Impact Objective for Pacific lamprey in the Rocky Reach Project has not been fully achieved in the first 5-year reporting period and will remain ongoing in the second 5-year period of the Rocky Reach License. Achievement of this objective will depend greatly on the time-frame and commercial availability of a bio-tested, active tag for tagging juveniles and measuring downstream passage effects.

#### Recommendations and Management Options Taken

Chelan PUD, in consultation with the RRFF, has accomplished objectives during the past 5 years to identify, measure, and address avoidable effects on Pacific lamprey due to Rocky Reach Project operations. Project effects have been identified and have been or are in the process

of being addressed. There are areas where additional data needs to be collected and discussions held in order to identify and address Project effects. Some areas, such as direct measurement of potential effects on downstream juvenile passage, may not be possible to identify and address until technologies and methods are satisfactorily developed. Discussions are occurring at present within the RRFF to determine the next steps to achieve NNI for Pacific lamprey at the Project.

Key discussions topics that have occurred within the RRFF include the following issues:

- Can tag technology produce an active tag in the near time-frame small enough with sufficient battery life to conduct juvenile lamprey survival studies?
- If a tag can be developed, then can a methodology be developed to conduct an unbiased juvenile lamprey survival study given the complexities of juvenile outmigration behavior?
- What is happening to adult Pacific lamprey in Rocky Reach reservoir given very low passage counts at the upstream dam and is it a Rocky Reach reservoir effect?
- Can an accurate assessment of adult lamprey behavior in reservoirs be conducted?
- Should Half-duplex PIT-tag detection equipment be installed in tributaries (Entiat River) to aid in determining approximate escapement percentages into the Entiat River and help to resolve unknowns about where adults go after exiting Rocky Reach Dam?
- Is there a role for artificial propagation of lampreys, beyond providing juvenile lamprey for study needs to achieve NNI, and if so, what would it entail without conducting effect studies prior to determine unavoidable effects?
- Can alternative strategies or off-site projects be used to achieve NNI even though studies to determine unavoidable project effects to juvenile lamprey downstream passage are yet to occur?
- How does information collected to answer the previous questions help to achieve NNI?

At present, the RRFF is discussing alternative actions and projects, both on-site and off-site that might be used to achieve NNI. Uncertainties identified through the previous questions need to be evaluated prior to the RRFF directing specific actions to measure and address unavoidable Project effects and achieve NNI. Ongoing efforts by the RRFF to identify specific actions to achieve NNI will be reported in the next 5-year Biological Objectives Status Report.

## **SECTION 6: RESIDENT FISH**

### **Goal**

The goal of the Rocky Reach Resident Fish Management Plan (RFMP) contained is to protect and enhance resident fish and habitat in the Rocky Reach Reservoir, and to enhance recreational fishing opportunities, when possible. Chelan PUD will continue to implement several resident fish Protection, Mitigation, and Enhancement measures (PMEs) as part of this Comprehensive Settlement Agreement, several of which are to continue funding for existing license measures for resident fish and to enhance recreational fishing opportunities. The objectives of these PME measures are: 1) continue to enhance recreational fishing opportunities; and 2) conduct resident fish monitoring to measure relative abundance and species composition in the reservoir.

### **6.1 Objective: No Negative Impacts on Native, Non-Stocked Resident Fish Species**

#### **Results of Monitoring**

The fish resources of Rocky Reach Reservoir include native resident species, introduced resident species and anadromous species. The native resident fish species include white sturgeon, mountain whitefish, rainbow trout, bull trout, northern pikeminnow, Peamouth chub, Chiselmouth chub, largescale sucker, longnose sucker, bridgelip sucker, redbreast shiner, sculpin, and threespine stickleback.

During the Rocky Reach Hydroelectric Project relicensing project, the Resident Fish Technical Group developed the Resident Fish Management Plan (RFMP) (Chelan PUD 2006). Protection, Mitigation, and Enhancement measures (PMEs) were developed to achieve the RFMP's goal. One RME required Chelan PUD to conduct a resident fish survey to assess potential predation effects of non-native predators on native fish and to estimate relative fish abundance and fish species composition in Rocky Reach Reservoir (Section 4.2 of the RFMP). In 2012, Chelan PUD contracted with the Washington Department of Fish and Wildlife (WDFW) Large Lakes Research Team to conduct a Rocky Reach Resident Fish Survey (Burgess et al. 2013) and assess means to increase recreational fishing opportunities through stocking of desirable game fish species.

Fyke nets, pop nets and electrofishing were used to sample fish during the summer and fall of 2012. Species composition was determined for all three sampling methods; catch per unit effort (CPUE) was estimated for electrofishing and fyke netting; and population abundance was estimated from the pop netting. Additionally, the data collected was used to calculate community metrics scores and an Index of Biotic Integrity (IBI) (Karr and Dudley 1981) for Rocky Reach Reservoir.

Species composition of fish captured with pop netting was dominated by the family *Gasterosteidae* (Table 6-1). Species composition and CPUE was dominated by northern pikeminnow, a native predator, during the summer and fall boat electrofishing and fyke netting efforts (Table 6-2). During the summer and fall surveys, 20 species of fish (seven non-native and 13 endemic to Washington State) were captured, including very low numbers of exotic predators. The IBI score for Rocky Reach Reservoir was classified as “Good-Fair”.

Table 6-1. Number of fish captured (*n*), the expanded population estimate (*N*), and species composition (%) using expanded population estimates of fish captured in summer pop nets within dense macrophyte mats at specific locations of the Rocky Reach Reservoir.

<b>Species</b>	<b><i>n</i></b>	<b><i>N</i></b>	<b>%</b>	<b>Species</b>	<b><i>n</i></b>	<b><i>N</i></b>	<b>%</b>
Chiselmouth	7	7	0.9	Sculpin spp.	21	22	2.7
Minnow spp.	1	1	0.1	Smallmouth bass	1	1	0.1
Northern pikeminnow	74	99	12.3	Sucker spp.	47	60	7.4
Peamouth	9	9	1.1	Threespine stickleback	435	568	70.5
Redside shiner	37	37	4.6	Unknown	2	2	0.2

Table 6-2. Percent species composition for electrofishing (EB%), fyke netting (FN%), and CPUE electrofishing (EB fish/hour) for summer and fall sampling at Rocky Reach Reservoir.

	Origin	Summer Sampling			Fall Sampling		
		EB%	FN%	EB fish/hour	EB%	FN%	EB fish/hour
Bluegill	Introduced	0.21	0.00	0.86	0.0	0.4	0.00
Bridgelip sucker	Native	0.46	0.00	1.89	0.5	0.0	2.40
Carp	Introduced	0.33	0.00	1.37	0.1	0.0	0.34
Chinook salmon	Native	0.04	0.71	0.17	16.8	5.6	77.49
Chiselmouth	Native	8.52	5.71	35.14	0.2	0.0	1.03
Largescale sucker	Native	22.10	9.29	91.20	11.1	1.6	51.26
Longnose sucker	Native	0.25	0.00	1.03	0.3	0.4	1.54
Minnow spp. <sup>1</sup>	Native	0.42	0.00	1.71	0.2	0.0	0.86
Northern pikeminnow	Native	30.83	60.00	127.20	15.5	8.7	71.49
Peamouth	Native	3.32	0.71	13.71	5.0	1.1	23.14
Pumpkinseed	Introduced	0.04	0.00	0.17	0.0	0.0	0.00
Redside shiner	Native	22.35	0.71	92.23	43.0	10.3	198.53
Sculpin spp.	Native	6.94	2.14	28.63	4.2	0.0	19.20
Smallmouth bass	Introduced	0.50	0.00	2.06	0.1	0.4	0.69
Steelhead	Native	0.00	0.00	0.00	0.0	0.2	0.00
Sucker spp.	Native	2.29	0.00	9.43	0.7	0.7	3.43
Tench	Introduced	0.46	2.86	1.89	0.0	0.0	0.17
Threespine stickleback	Native	0.37	17.86	1.54	1.2	70.4	5.66
Walleye	Introduced	0.04	0.00	0.17	0.1	0.0	0.51
Whitefish	Native	0.46	0.00	1.89	0.8	0.0	3.77
Yellow Perch	Introduced	0.08	0.00	0.34	0.1	0.2	0.69

<sup>1</sup>All minnows unidentified to species were of native origin.

The composition of the fish assemblage in Rocky Reach Reservoir and the spatial distributions of the various species present are similar to those reported for other similar run-of-the-river reservoirs in the upper Columbia River drainage (Duke Engineering and Services 2001). The results and conclusions from Burgess et al. 2013 characterized the native resident fish assemblage in Rocky Reach Reservoir as relatively unchanged compared to pre-project construction. The report also confirmed limited presence of non-native predators (i.e., smallmouth bass and walleye). Project operations have not drastically changed fish habitat within Rocky Reach Reservoir. Project operational characteristics reduce the frequency and magnitude of forebay-reservoir water surface fluctuations to approximately two feet, although four feet of reservoir draft is available power and non-power uses (e.g. Hanford Reach, Vernita Bar Agreement). This operational regime limits fish stranding along the shoreline or entrapment of fish in isolated pools as water recedes (BioAnalysts 2000, Chelan PUD 2008), reducing negative impacts to resident juvenile fish. Additionally, project operations that maintain a run-of-the-river reservoir, continues to provide habitat for resident, native fish. With very limited

water storage capability, movement of river water through Rocky Reach Reservoir is rapid with mean monthly reservoir water resident times between 1.25 to 3.01 days, and average water velocities between 0.88 to 2.27 feet per second (Chelan PUD 2012).

#### Degree of Achievement of Objective

This Biological Objective has been achieved for the evaluation time frame 2008 through 2013. The RRFF has recommended no new management options or implementation measures specific to monitoring resident fish in the Rocky Reach reservoir or fish stocking measures to enhance recreational fishing opportunities.

Study results and conclusions reported by Burgess et al. 2013 identified no negative impacts from the Rocky Reach Project operations to native, non-stocked resident fish assemblages in the reservoir and determined that non-native predator abundance was very low. The RRFF determined that stocking of any additional desirable game fish in the Rocky Reach Reservoir (not currently present species) to enhance recreational fishing is not advisable, as any additional game species desired by anglers would also be a predator of desirable native anadromous salmon and steelhead juveniles and other native species currently present in the reservoir.

#### Recommendations and Management Options Taken

No specific management options were used in the evaluation time frame because the Resident Fish Objective was achieved. Chelan PUD and the RRFF propose to maintain Rocky Reach Project current operations over the next five-year period, and continue appropriate monitoring to ensure protection for native non-stocked resident fish species.

Chelan PUD in consultation with the RRFF have determined that Chelan PUD will conduct three more similar resident fish evaluation studies (also specified in the RFMP) once every 10 years over the next 30 year period (2023, 2033, and 2043) to maintain achievement of this Biological Objective for resident fish species.

## **SECTION 7: LITERATURE CITED**

- Amaral, S.V., G. Hecker, and P. Stacy. 2008. Effects of leading edge turbine blade thickness on fish strike survival and injury. Hydro Vision, HCI publication, Number 250.
- Anders, P. and S. Lee. Pacific Lamprey Passage Evaluation: Rocky Reach Dam 2011-12. Scope of Work provided to Chelan PUD. May 2011.
- Beamish, R. J. 1987. Evidence that parasitic and nonparasitic life history types are produced by one population of lamprey. Canadian Journal of Fisheries and Aquatic Sciences 44:1779-1782.
- Beamish, R. and T. Northcote. 1989. Extinction of a population of anadromous parasitic lamprey, *Lampetra tridentata*, upstream of an impassable dam. Canadian Journal of Fisheries and Aquatic Sciences 46:420-425.
- BioAnalysts. 2000. Effects of pool fluctuations on natural resources in the Rocky Reach Project Area. BioAnalysts, Redmond, Washington and Boise, Idaho.
- Buchanan, R. and J. R. Skalski. 2011. Estimation of Spring Chinook Conversion Rates through the Rocky Reach Project, 2009-2011. Columbia Basin Research, School of Aquatic and Fishery Sciences, University of Washington. Seattle, Washington.
- Buchanan, R. and J. R. Skalski. 2012. Estimation of the Adult Salmon and Steelhead Conversion Rates through the Rock Island and Rocky Reach Projects, 2010-2012. Columbia Basin Research, School of Aquatic and Fishery Sciences, University of Washington. Seattle, Washington.
- Burgess, D., K. Simmons, R. Polacek, J. Rogala, and F. Wichterman. 2013. Rocky Reach Project resident fish survey. Washington Department of Fish and Wildlife, Ellensburg, Washington.
- Burnham, K.P., Anderson, D.R., White, G.C., Brownie, C., and Pollock, K.H. 1987. Design and analysis methods for fish survival experiments based on release-recapture. American Fisheries Society Monograph 5.
- Chelan PUD. 1991. Application for raising pool elevation for 707 ft to 710 ft. Rocky Reach Hydroelectric Project No. 2145. Chelan County Public Utility District, Wenatchee, Washington.
- Chelan PUD. 2002. Anadromous Fish Agreement and Habitat Conservation Plan (HCP). Rocky Reach Hydroelectric Project. FERC License No. 2145. March, 2002.
- Chelan PUD. 2005a. Rocky Reach Comprehensive Bull Trout Management Plan. Rocky Reach Hydroelectric Project, FERC Project #2145. 2005.

- Chelan PUD. 2006. Resident Fish Management Plan. In Rocky Reach Comprehensive Settlement Agreement. Rocky Reach Hydroelectric Project No. 2145.
- Chelan PUD 2008. Reasonable and Prudent Measures and Associated Terms and Conditions for the Protection of Bull Trout. 2008 Annual Report and Final Summary of RPMs and Incidental Take Monitoring for Years 2005-2008. Prepared by Chelan PUD, April 14, 2009.
- Chelan PUD. 2008. Rocky Reach Bull Trout Management Plan. Rocky Reach License Settlement Agreement, Article 4. Prepared by Chelan PUD, 2004. Wenatchee, WA.
- Chelan PUD. 2009. Reasonable and Prudent Measures and Associated Terms and Conditions for the Protection of Bull Trout. 2008 Annual Report and Summary of RPMs and Incidental Take Monitoring for Years 2005-2008. Report to Federal Energy Regulatory Commission and U.S. Fish and Wildlife Service. Rocky Reach and Rock Island Hydroelectric Project, 2009.
- Chelan PUD. 2010. Memo dated December 3, 2010 to the Rocky Reach Fish Forum. Juvenile lamprey impingement monitoring at Rocky Reach Dam.
- Chelan PUD. 2012a. Rocky Reach Pacific Lamprey Management Plan: Distribution, Composition, and Abundance of juvenile lampreys (*Lampetra* sp.) within the observed operating range of Rocky Reach Reservoir, 2011. Study report to the Rocky Reach Fish Forum, March 2012. 5pp.
- Chelan PUD. 2012b. Evaluation of Rocky Reach Reservoir water particle travel time measured as mean monthly full content reservoir turn-over rate, 2001-2012. [http://www.chelanpud.org/documents/39605\\_Rocky\\_Reach\\_Residence\\_Time\\_Velocity.pdf](http://www.chelanpud.org/documents/39605_Rocky_Reach_Residence_Time_Velocity.pdf)
- Chelan PUD. 2013a. Memo dated December 16, 2013 to the Rocky Reach Fish Forum. 2013 diversion screen and vertical barrier screen (VBS) monitoring for juvenile lamprey impingement, units 1 and 2 at Rocky Reach Dam.
- Chelan PUD. 2013b. Rocky Reach 2013 adult Pacific lamprey HD detection and passage summary report. Report to the Rocky Reach Fish Forum. December 2013.
- Close, D., M. Fitzpatrick, H. Li, B. Parker, D. Hatch, and G. James. 1995. Status report of the Pacific lamprey (*Lampetra tridentata*) in the Columbia River basin. Project No. 94-026, Contract No. 95BI39067. Report to the U.S. Department of Energy, Bonneville Power Administration, Portland, OR.
- Colotelo, A.H., B.D. Pflugrath, R.S Brown, C.J. Brauner, R.P. Mueller, T.J. Carlson, Z.D. Deng, M.L. Ahmann, and B.A. Trumbo. 2012. The effect of rapid and sustained decompression on barotrauma in juvenile brook lamprey and Pacific lamprey: Implications for passage at hydroelectric facilities. Fisheries Research 129-130 (2012) 17-20.



[http://www.chelanpud.org/documents/39131\\_Colotelo\\_RRFF\\_-\\_lamprey\\_barotrauma\\_presentation\\_August\\_2012.pdf](http://www.chelanpud.org/documents/39131_Colotelo_RRFF_-_lamprey_barotrauma_presentation_August_2012.pdf)

- Douglas PUD. 2013. Memorandum to HCP Coordinating Committee: 2012 Subyearling Life History Study: Comparing 2011 and 2012 results. 2013 Tech Memo to Wells HCP Coordinating Committee. March, 2013.
- Duke Environmental Services 2001. Aquatic Habitat Mapping Study Report. Prepared for Public Utility District No. 1 of Chelan County, Wenatchee WA. 98802. 103 pp.
- Duke Engineering and Services. 2001. Rocky Reach fish use and habitat survey. Duke Engineering and Services, Inc., Bellingham, Washington.
- GeoEngineers, Inc., U.S Fish and Wildlife Service, and U.S Geological Survey. 2011. Pacific Lamprey Artificial Propagation and Rearing Investigations: Rocky Reach Pacific Lamprey Management Plan. Final report to Public Utility District No. 1 of Chelan County, June 15, 2011.
- Golder Associates. 2009. Upper Columbia River juvenile white sturgeon monitoring: Phase 5 investigations, November 2006. Report prepared for BC Hydro, Revelstoke, B.C
- Hansen, M.J., Adams, J.V., Cuddy, D.W., Richards, J.M., Fodale, M.F., Larsen, G.L., Ollila, D.J., Slade, J.W., Steeves, T.B., Young, R.J., and Zerrenner, A. 2003. Optimizing larval assessment to support sea lamprey control in the Great Lakes. *J. Great Lakes Res.* 29 (Suppl. 1):766–782.
- Hillman, T., M. Miller, A. Murdoch, T. Miller, J. Murauskas, S. Hays, and J. Miller. 2012. Monitoring and evaluation of the Chelan County PUD hatchery programs: five-year (2006-2010) report. Report to the HCP Hatchery Committee, Wenatchee, WA.
- Kan, T. 1975. Systematics, variation, distribution, and biology of lampreys of the genus *Lampetra* in Oregon. Doctoral dissertation. Oregon State University, Corvallis, OR.
- Karr, J.R. and D.R. Dudley. 1981. Ecological perspective on water quality goals. *Environmental Management* 5:55-68.
- Le, B. and B. Nass. 2010. Pacific Lamprey Upstream Passage Modifications Literature Review and Analysis and Recommendations for Passage Improvements in the Rocky Reach Fishway. Rocky Reach Hydroelectric Project (FERC No. 2145). Report prepared for Chelan PUD, Wenatchee, WA. June 2010.
- Mosey, T. R., S. L. Hemstrom, and J. R. Skalski. 2004. Study Plan for the Biological Evaluation for the Rocky Reach Fish Bypass System-2004. Chelan County Public Utility District, Wenatchee, Washington.

- Mueller, R. M. 2012. Effects of Dam Passage on Juvenile Pacific Lamprey: Field and Laboratory Studies. Pacific Northwest National Laboratory, Richland, WA. Presentation to the Rocky Reach Fish Forum, August 2, 2012. [http://www.chelanpud.org/documents/39130\\_Mueller\\_JPL\\_seminar\\_presentation\\_August\\_2012.pdf](http://www.chelanpud.org/documents/39130_Mueller_JPL_seminar_presentation_August_2012.pdf)
- Murauskas, J., S. Hemstrom, J. Miller, and L. Keller. Rock Island and Rocky Reach Anadromous Fish Agreements and Habitat Conservation Plans. 2013 Comprehensive Progress Report. Chelan PUD. May, 2013.
- Ostrand K.G., K.C. Hanson, and A.S McNamee. 2011. Manual for Intensive Culture of Pacific Lampreys. Report to Public Utility District No. 1 of Chelan County, March 31, 2011.
- Pletcher, F. 1963. The life history and distribution of lampreys in the Salmon and certain other rivers in British Columbia, Canada. Master's thesis. University of British Columbia, Vancouver, B.C.
- Richards, J. 1980. Freshwater life history of the anadromous Pacific lamprey, *Lampetra tridentata*. Master's thesis. University of Guelph, Guelph, Ontario.
- RRFF. 2010a. Rocky Reach Fish Forum. Meeting minutes of the RRFF. February 25, 2010. Wenatchee, WA.
- RRFF. 2010b. Rocky Reach Fish Forum. Meeting minutes of the RRFF. October 8, 2010. Wenatchee, WA.
- RRFF. 2011a. Rocky Reach Fish Forum. Meeting minutes of the RRFF. May 4, 2011. Wenatchee, WA.
- RRFF. 2011b. Rocky Reach Fish Forum. Meeting minutes of the RRFF. February 2, 2011. Wenatchee, WA.
- RRFF. 2012a. Rocky Reach Fish Forum. Meeting minutes of the RRFF. January 4, 2012.
- RRFF. 2012b. Rocky Reach Fish Forum. Meeting minutes of the RRFF. May 2, 2012.
- RRFF. 2012c. Rocky Reach Fish Forum. Meeting minutes of the RRFF. July 10, 2012.
- RRFF. 2012d. Rocky Reach Fish Forum. Juvenile lamprey survival at Rocky Reach Dam effects analysis. Draft report, August 30, 2012. Wenatchee, WA.
- RRFF. 2013a. Rocky Reach Fish Forum. Meeting minutes of the RRFF. February 6, 2013.
- RRFF. 2013b. Rocky Reach Fish Forum. Meeting minutes of the RRFF. May 1, 2013.

- RRFF. 2013c. Rocky Reach Fish Forum. Meeting minutes of the RRFF. June 2013. Wenatchee, WA.
- RRFF. 2013d. Rocky Reach Fish Forum. Meeting minutes of the RRFF. October 2013. Wenatchee, WA.
- Skalski, J.R. 2012. Considerations in designing juvenile lamprey survival studies. Juvenile Pacific Lamprey Seminar, August 1, 2012.
- Skalski, J.R. and R.L. Townsend. 2013. Preliminary sample size calculations to estimate dam passage survival of lamprey. Technical memo to Steve Hemstrom, Chelan PUD. Columbia Basin Research, School of Aquatic and Fishery Sciences. University of Washington. January 2013.
- Stevenson, J.R., P. Westhagen, D.J. Snyder, J.R. Skalski, and A.E. Giorgi. Evaluation of adult Pacific Lamprey passage at Rocky Reach Dam using Radiotelemetry techniques, 2004. Report prepared for Chelan PUD. March 23, 2005.
- Stevenson, J.R., D.J. Snyder and M. Miller. 2009. Movement of Radio-Tagged Bull trout Through Rocky Reach and Rock Island Dams and Reservoirs: 2005-2009. Report to Chelan PUD. Submitted by BioAnalysts, Inc. Redmond, WA. December, 2009.
- USFWS. 2004. U.S. Fish and Wildlife Service. Biological Opinion and Conference Opinion for the License Amendments to Incorporate the Rocky Reach, Rock Island and Wells Anadromous Fish Agreements and Habitat Conservation Plans. May 14, 2004.
- USFWS. 2008. U.S. Fish and Wildlife Service. Biological Opinion on the Effects of the Rocky Reach Hydroelectric Project Relicensing on Bull Trout (FERC No. 2145). December 2008.
- Wade, J. and R.J. Beamish, 2012. Pacific Lamprey (*Lampetra tridentata*) Breeding and Rearing Methodologies – Recommendations for Chelan County PUD. Final report to Public Utility District No. 1 of Chelan County, September 2012.
- Wright, C.D. Blue Leaf Environmental, Inc., Personal Communication.
- Wright, C.D. and D. Robichaud. 2013. Rocky reach reservoir white sturgeon indexing and monitoring annual report 2012. Final report prepared for Public Utility District No. 1 of Chelan County, Washington by Blue Leaf Environmental, Inc., LGL Limited, and Columbia Research.
- Wydoski, R. S. and R. R. Whitney. 2003. Inland fishes of Washington. American Fisheries Society, Bethesda, Maryland in association with University of Washington Press, Seattle and London, University of Washington Press, Singapore.

***APPENDIX A: CONSULTATION RECORD***

---

Chelan PUD provided a draft of the 2013 Rocky Reach Biological Objectives Status Report to Ecology and members of the RRFF on February 1, 2014 with a five-week review period between February 1 and March 7. Additional comments were received and accepted after March 7. An extended period of time was allowed by Ecology for Chelan PUD to reformat and revise the draft report to incorporate RRFF comments. Ecology has requested a second review period for the RRFF before finalizing the report. This document is Draft #2.

The following individuals were sent first draft copies for review:

<i><b>NAME</b></i>	<i><b>AGENCY</b></i>
Irle, Pat	Washington State Department of Ecology
Dave Burgess	Washington State Department of Fish and Wildlife
Patrick Verhey	Washington State Department of Fish and Wildlife
Maitland, Travis	Washington State Department of Fish and Wildlife
Chad Jackson	Washington State Department of Fish and Wildlife
Jeff Korth	Washington State Department of Fish and Wildlife
Brad James	Washington State Department of Fish and Wildlife
Katrina Simmons	Washington State Department of Fish and Wildlife
Steve Lewis	US Department of the Interior – Fish and Wildlife Service
RD Nelle	US Department of the Interior – Fish and Wildlife Service
Glesne, Reed	National Park Service
Susan Rosebrough	National Park Service
Lewis, Steve	United States Fish and Wildlife Service
Bryan Nordlund	National Marine Fisheries Services
Yeager, Justin	National Marine Fisheries Services
Kirk Truscott	Confederated Tribes of the Colville Reservation
Jason McClellan	Confederated Tribes of the Colville Reservation
Rose, Bob	Yakama Indian Nation
Donella Miller	Yakama Indian Nation
Ralph Lampman	Yakama Indian Nation
Aaron Jackson	Confederated Tribes of the Umatilla Reservation
Tom Skiles	Columbia River Inter-Tribal Fish Commission
Matthew Kerec	ALCOA
Bob Huber	ALCOA
Ken Finicle	Puget Sound Energy
Keith Vradenburg	City of Entiat
Andrew Gingerich	Douglas County PUD
Mike Clement	Grant County PUD
Steve Rainy	Public
Archibald, Phil	Lake Chelan Sportsman Association
Josh Murauskas	Anchor QEA
Joe Miller	Anchor QEA
Cory Wright	Blue Leaf Environmental
Paul Anders	Cramer Fish Sciences

Commenting Agency	Agency Comment	Chelan PUD Response
<p>YN 2/21/14 Draft Report comments</p>	<p><b>Section 1, Introduction, Table 1-1, Page 3.</b> Results observed?</p>	<p>Adult lamprey passage success at many similar mainstem hydroelectric projects in the Snake and Columbia rivers is still being evaluated, as is passage success at Rocky Reach in 2014 to evaluate ladder modifications made for adult Pacific Lamprey.</p>
<p>YN 2/21/14 Draft Report comments</p>	<p><b>Section 2, Habitat Conservation Plan, Page 5.</b> Coho are a planned species.</p>	<p>Coho added to description of HCP Plan Species in Paragraph 2.</p>
<p>YN 2/21/14 Draft Report comments</p>	<p><b>Section 2, Page 5.</b> <sup>1</sup>An interim juvenile survival value of 93% for Coho was assumed and agreed to by the HCP CC</p>	<p>Coho added to Table 2-2 with interim juvenile survival value of 93% as agreed by the HCP CC.</p>
<p>YN 2/21/14 Draft Report comments</p>	<p><b>Section 2, Page 7.</b> Please briefly specify what these uncertainties are and how the PUD anticipates addressing them.</p>	<p>Uncertainties have been briefly described in the revised draft report.</p> <p>The key uncertainty is the ability of a JSATS micro acoustic tag to possess adequate battery life to remain operational while implanted in a small fish during a Project-wide (full reservoir and dam) juvenile passage studies as required by the HCP; wild origin subyearling Chinook may spend a month or more migrating 43 miles through Rocky Reach Reservoir, and may overwinter in the reservoir, out-migrating the following spring. Because tag detection arrays (full river-width detection points) are even further downstream at 10 and 20 miles <i>below Rocky Reach Dam</i>. Tags must remain 100% operational with complete certainty during the full 53 and 63 mile distances the fish must travel to reach each detection points. If tags do not perform this amount of time, bias exists that may dramatically affect study results. Additionally, each</p>

Commenting Agency	Agency Comment	Chelan PUD Response
		tagged fish must migrate with 100% certainty to avoid violating a second key Burnham mark–recapture assumption in a paired release survival study. If a tag battery fails before a fish crosses detection points, or a tagged fish is alive but does not outmigrate past detection points during the study, the study assumptions are violated, and survival estimates will be biased without the researcher’s knowledge. These issues exist with estimating subyearling Chinook salmon passage survival.
YN 2/21/14 Draft Report comments	<b>Section 2, Page 7.</b> I’m not tracking the logic here. How can you state the calculated migration time range in one sentence, and then conclude in the next that survival testing can’t be done? I’d suggest discussing what prevents a PIT tag survival study for suby to be successful. I note that suby survival studies are conducted elsewhere, and the differences between elsewhere and CPUD projects is not clear.	Comment noted. Please refer to Mark-recapture parameters and the 12 critical assumptions of a Burnham paired release mark-recapture study. For all HCP studies to date, to ensure representative fish are used, Chelan PUD utilizes run-of-river fish (juvenile HCP Plan Species) captured at Rocky Reach juvenile bypass system to conduct all survival studies for the Rocky Reach Project. In 2010, the Wells’ HCP Survival Verification Study required that Douglas PUD tag and release 80,000 spring Chinook. It is not reasonably feasible or even physically possible to collect these numbers of subyearling Chinook at the Rocky Reach to conduct a PIT study. Subyearling survival studies at FCRPS Projects are all conducted using Acoustic tags, not PIT tags, and the FCRPS BiOp requirement is to estimate <i>dam passage survival only</i> , not full project survival as is required by HCP studies. FCRPS studies do not measure juvenile reservoir passage survival.
YN 2/21/14 Draft Report comments	<b>Section 2, Page 8.</b> I think this only applies in the absence of a ‘continuing hatchery program’.	Comment noted.

Commenting Agency	Agency Comment	Chelan PUD Response
<p>YN 2/21/14 Draft Report comments</p>	<p><b>Section 2, Page 8.</b> However, Chelan PUD is no longer entering into sharing agreements with DCPUD and therefore is currently lacking in adult capture facilities and acclimation facilities for their Rocky Reach spring Chinook mitigation in the Methow basin. Perhaps this statement needs updating. The RR trap is being tested for Methow Broodstock collection purposes in 2014 but it is uncertain if enough broodstock can be collected there. Acclimation will take place in a YN Expanded Acclimation pond.</p>	<p>Comment noted. The period of review for this report is 2009 through 2013. Chelan PUD achieved compliance with NNI compensation through its HCP hatchery production in those years. The HCP HC is currently using adaptive management to evaluate brood stock collection options for Chelan PUD’s Methow spring Chinook obligations and alternative pilot collection of broodstock is occurring currently at Rocky Reach Dam.</p>
<p>YN 2/21/14 Draft Report comments</p>	<p><b>Section 2, Table 2-8, Page 13.</b> How is it that the range does not include the estimate?</p>	<p>Rock Island to Wells adult steelhead conversion rate and confidence interval were incorporated incorrectly in the table. Correct numbers for Rock Island to Wells Conversion are <math>\hat{S}= 1.13\%</math>, <math>SE=0.0094</math>, 95% CI: 1.1158 - 1.1527 are corrected in the revised report.</p>
<p>YN 2/21/14 Draft Report comments</p>	<p><b>Section 2, Page 14.</b> It’s not intuitive why summer/fall Chinook sport fishing harvest cannot be accounted for and spring Chinook/sockeye/steelhead can be. Can spring Chinook and steelhead even be harvested between RI and Wells? Explain.</p>	<p>There is no mainstem sports fishery harvest above McNary Dam for spring Chinook. However, there is sport fishery harvest for steelhead in the mainstem between Rock Island Dam and Wells Dam, and in the Wenatchee and Entiat rivers for hatchery-origin steelhead. Adequate harvest data for summer/fall Chinook originating from above Wells Dam is lacking for estimation of sport harvest effects on conversion rates for these fish. These fish are not ESA listed so creel census effort may reflect this. Recent returns of PIT tagged summer/fall Chinook as part of Chelan PUD’s Similkameen/Bonaparte programs, along with the Colville’s and DCPUD programs too may allow for estimates in the future if creel information can be collected.</p>
<p>YN 2/21/14 Draft Report</p>	<p><b>Section 4, White Sturgeon, Page 22.</b> General note that the objectives in this report are inconsistent with the objectives of the WSMP. Is there a reason for this??</p>	<p>The objectives in the Biological Objectives report are specific to Objectives in the 401, and may appear different because they are the Biological Objectives for Beneficial</p>



Commenting Agency	Agency Comment	Chelan PUD Response
comments		Uses as specified by Ecology in Water Quality Certification, and are not the more specific objectives found in the Rocky Reach WSMP.
YN 2/21/14 Draft Report comments	<b>Section 4, Page 22.</b> Increase the White Sturgeon Population in the Rocky Reach Reservoir.	Comment noted. See response Chelan PUD response to question above. The wording of this objective may not match the WSMP exactly.
YN 2/21/14 Draft Report comments	<b>Section 4, Page 23.</b> <i>Objective 2: Determine the Effectiveness of the Supplementation Program (Monitoring)</i>	Comment noted. The specific Biological Objectives set in the 401 by Ecology for this report may appear different than WSMP Objectives. Chelan PUD did not choose which specific Biological Objectives to report on.
YN 2/21/14 Draft Report comments	<b>Section 4, Page 25.</b> What about tagged fish in 2011 and 12 -- don't we have information from them??	Yes. Early tracking data from acoustic tagged fish in each year's release group shows similar behavior with fish detected in the upper end of the reservoir, and in 2013 trends were the same with 60% of the tagged fish found above the most upstream release location. Sentenced modified to add this information.
YN 2/21/14 Draft Report comments	<b>Section 4, Page 25.</b> Does this imply that CCPUD does not intend to stock beyond 2014? Why not simply say that 2014 is the fourth year of stocking?	No. Chelan PUD intends to stock juvenile sturgeon beyond 2014, as clearly intended in the WSMP. Please refer to the Rocky Reach WSMP. 2014 is described here as part of the initial 3-year phase of initial stocking because only 147 juveniles could be stocked into Rocky Reach Reservoir in 2012 due to WS iridovirus detected in the juvenile fish.
YN 2/21/14 Draft Report comments	<b>Section 4, Page 25.</b> It may be more accurate to say that broodstock collection has been underfunded to date to obtain the desired crosses in the WSMP.	Comment noted. Chelan PUD funded contracts from 2010 through 2013 to collect adult brood, and spawn, and rear juvenile White sturgeon. The cost of these measures was \$495,374. Chelan PUD does not agree that adult brood collection efforts are underfunded.

Commenting Agency	Agency Comment	Chelan PUD Response
YN 2/21/14 Draft Report comments	<b>Section 4, Page 25.</b> <i>shall</i>	Word “should” changed to “will” to mean “shall”.
YN 2/21/14 Draft Report comments	<b>Section 4, Page 25.</b> funding levels, strategies, and sources...	Comment noted.
YN 2/21/14 Draft Report comments	<b>Section 4, Page 25.</b> Objective 3: Determine Carrying Capacity of Available Habitat in Rocky Reach Reservoir	Comment noted. Objective 4.3 in this report may appear slightly different than objectives specific to the White Sturgeon Management Plan because this report details the status of Biological Objectives required under the Rocky Reach 401 Water Quality Certification, and hence they are not 100 percent identical. Please see 401 Objectives for Rocky Reach.
YN 2/21/14 Draft Report	<b>Section 4, Page 26.</b> Carrying capacity is another attribute that should be listed	The phrase, “ <i>and determine carrying capacity</i> ” was added to the description of initial index and monitoring study objectives. The monitoring and evaluation program is expected to provide information to understand carrying capacity of the reservoir for White Sturgeon.
YN 2/21/14 Draft Report comments	<b>Section 4, Page 26.</b> Is intended	Sentence modified by replacing <i>should</i> with the words <i>is intended</i> in the revised report.
YN 2/21/14 Draft Report comments	<b>Section 4, Page 26.</b> How do we know this -- where is this number made available??	This language is in reference to several cohort releases of fish having three different age groups. Sentence changed to remove the word cohort and replace with different age groups of juveniles consisting of approximately 19,500

Commenting Agency	Agency Comment	Chelan PUD Response
<p>YN 2/21/14 Draft Report comments</p>	<p><b>Section 4, Page 26.</b> Not exactly sure what this statement means -- it would be helpful to state that introduction of juveniles into the reservoir each year will provide the best chance of survival and will insure the best chance for a wide range of age classes. Also - is it just a wide range of age classes - or also an appropriate number of fish per age class??</p>	<p>individuals. Sentenced changed to say, “<i>Collaboration between the Co-Managers, the RRFF, and Chelan PUD to identify and collect supplementation fish should persist to ensure that the appropriate number of individuals representing multiple age classes and are present with stable age structure by year 20 of the WSMP and beyond.</i> There is no specific number of individual fish that are required to make up each age class except to strive for a stable age structure, which is yet to be defined by the RRFF through monitoring.</p>
<p>YN 2/21/14 Draft Report comments</p>	<p><b>Section 4 Page 26.</b> Should?? --- a little more definition here would be helpful - i.e. Chelan shall advocate to the RRFF that these release strategies should be implemented....</p>	<p>The word “<i>should</i>” is changed to “<i>will</i>”, <i>in consultation with the RRFF</i>, continue to refine release strategies to help achieve good survival....”</p>
<p>YN 2/21/14 Draft Report comments</p>	<p><b>Section 4, 4.4 Objective 4, Page 25.</b> Determine Natural Reproduction Potential and Adjust Supplementation Program Accordingly. Where is this Objective??</p>	<p>Comment noted. The Objectives may appear different between 401 Biological Objectives reported on here, and the WSMP Objective noted. The RRFF is striving to achieve the specific objectives in the WSMP. See table 1-1 for link to Beneficial Use descriptions.</p>
<p>YN 2/21/14 Draft Report comments</p>	<p><b>Section 5 Pacific Lamprey, Page 27.</b> The second sentence indicates that three years of monitoring is sufficient to "complete this Biological Objective". This is mis-leading, as the testing is completed, but the Objective is not necessarily met.  The final statement is mis-leading as it is not necessary to have all other mainstem dams completed prior to "completing this objective". It is unclear what this statement is meant to say.</p>	<p>Second sentence was revised to say “<i>Two years of monitoring tagged lamprey has occurred, and at least one additional year of monitoring ladder passage improvement is needed to determine the next steps, or confirm whether this Biological Objective is achieved or not achieved. The number of additional years of ladder passage monitoring to achieve this objective is not known at this time. Additionally, passage monitoring at other mainstem hydroelectric projects is ongoing to assess comparable passage rates for comparison to Rocky Reach. No other</i></p>

Commenting Agency	Agency Comment	Chelan PUD Response
		<p><i>Project has on the Snake or Columbia rivers has yet to report completion of ladder passage monitoring or establishment of metrics for adult lamprey passage efficiency. This Biological Objective is therefore still in progress at Rocky Reach.</i>” The existing sentence says “passage monitoring at other mainstem projects. There is no reference to “<i>all other mainstem dams</i>”, as stated in the YN comment. Chelan PUD is unaware of any of the mainstem hydro projects that have completed adult lamprey passage testing at this time for comparison. The Rocky Reach PLMP requires that adult lamprey passage at Rocky Reach achieves rates similar to the best passage rates at other mainstem hydroelectric projects in the Snake and Columbia rivers. Passage studies are still being conducted at Rocky Reach and other facilities. The RRF can determine when adequate testing has occurred to make comparisons of passage rates.</p>
<p>YN 2/21/14 Draft Report comments</p>	<p><b>Section 5, Page 28.</b> Paragraph 7, last sentence should be expanded upon, as this is very relevant information that is being left out. Specifically, were any fish released by the USACE in 2011 found in the fishway in 2012? Since no fish in the 2012 test were found in 2013, doesn't this lend useful information that is often brought up that "we can't tell what the actual passage was in Year X, because the fish might not occur until the following year". There is quite a bit of speculation in this document, so I suggest that it is useful to speculate that the 2013 results are indicative that passage wasn't very good, and might not be.</p>	<p>Comment noted. Sentences in this paragraph make no speculation or hypotheses regarding what passage might be or could be, but simply report facts on fish detected within each migration year at Rocky Reach.</p>

Commenting Agency	Agency Comment	Chelan PUD Response
YN 2/21/14 Draft Report comments	<b>Section 5, Page 28.</b> In general, a picture of the locations of the arrays would be very helpful in following this discussion.	Diagram of Rocky Reach fishway and installed HD PIT tag antennas locations has been prepared and included in the revised report.
YN 2/21/14 Draft Report comments	<b>Section 5, Page 28.</b> Tables 5-2 and 5-3 contain essentially the same information, but one with considerable more detail than the other. It would be informative if 5-1 were the same as 5-2.	Table 5-1 reports physical locations of antennas in the Rocky Reach fishway. Table 5-2 and 5-3 contain tag passage data from individual fish in 2012 and 2013. We are unsure how to make Table 5-1 appear like Table 5-2 because they contain vastly different data. Detailed detection times and detection locations for 2012 adult passage were added to Table 5-2, as we believe that is what your comment intended to say.
YN 2/21/14 Draft Report comments	<b>Section 5, Table 5-3, Page 29.</b> I note that five of the fish were not first detected until they reach the 6th or 7th receiver. What does this say about detection capacity and confidence in drawing conclusions from this information? Also, fish AEC5BB was able to go from Location 03 to 07 in 13 seconds.....please check this information again.	None of the half-duplex antennas at Rocky Reach possess 100% detection efficiency. Cramer Fish Science reports that no half-duplex antennas in fishways anywhere in the Columbia achieve 100% detection efficiency. Lamprey may pass, but escape detection at one or more antennas in fishway, hence the need for multiple antennas in the same fishway and detection locations further upstream at the next dam. In 2011, Army Corps reported that a total of 323 lampreys were detected at antennas upstream from Bonneville Dam. Of these, only 282 (87.3%) fish were actually detected at any Bonneville fishway half-duplex antenna. <a href="http://nwpapps.usace.army.mil/environment/docs/afep/draft/2011_Sys_LMP_LCRMmigration_DRAFT.pdf">http://nwpapps.usace.army.mil/environment/docs/afep/draft/2011_Sys_LMP_LCRMmigration_DRAFT.pdf</a>  Error corrected in Table 5-3. Adult lamprey AECC5BB was not first detected at RR03 as reported. It was first detected at RR07 at 4:12:23 on August 12, 2013, and then detected again at 4:12:56 the same day. It is assumed to

Commenting Agency	Agency Comment	Chelan PUD Response
		have passed as this was its last detection anywhere in the fishway.
<p>YN 2/21/14 Draft Report comments</p>	<p><b>Section 5, Page 29.</b> I am disappointed that there really isn't any information conveyed that suggests if the past fishway work described in Paragraph 2 and Paragraph 4 provided any notable improvement in passage. Wouldn't some mention of the baseline conclusions from the earlier telemetry work provide insights to progress made from the last five years?</p>	<p>Only two years of passage monitoring is available to draw conclusions. Any baseline conclusion drawn from a small sample size of tagged fish is not likely appropriate, whether the conclusions that are drawn are good or bad. Chelan PUD avoids drawing even baseline conclusions in this report given that monitoring has not concluded and may require three to five years or more to complete. Chelan PUD has contacted the US Army Corps and is aware that the Corps will tag up to <b>an additional 5,000 adult lamprey</b> in 2014 to assess passage at McNary Dam; the RRFF is aware of this and hopes to increase the tagged fish sample size at Rocky Reach from this effort. In 2014 Chelan PUD completed an analysis adult conversion rates between Rock Island and Wells dam based on fishway window counts. The RRFF is currently reviewing this work. The analysis of non-tagged adult fish counted between Projects is noteworthy and promising; although we make no conclusions about comparison of passage efficiency before and after passage ladder improvements were completed.</p>
<p>YN 2/21/14 Draft Report comments</p>	<p><b>Section 5, Page 29.</b> Later in the document there is much to do about the need for statistical rigor to test juvenile survival. But in this Adult section, there is no mention of statistical rigor - or even the notion that CCPUD should improve its sample size. Why? Later in the document, there is discussion about RRFF conversations about potential future actions- and certainly, the discussion about more adults in the sample has come up in these</p>	<p>Comment noted. It is fact that juvenile mark-recapture passage studies require vastly more fish to conduct conclusive passage studies to assess survival. Juvenile release groups must have adequate fish numbers to achieve acceptable errors bounds on estimates; this is imperative to draw conclusions on effect and survival. Because fishway improvements</p>

Commenting Agency	Agency Comment	Chelan PUD Response
	<p>meetings. Why is the need for more fish in the sample - or the stated interest of the RRF not brought forward here?</p>	<p>were completed and monitoring began both in the year 2012, it is unlikely that at Rocky Reach, or any project we know of on the Columbia, could make precise estimates of differences in adult passage with ability to detect differences smaller than 30%. The US Army Corps's 2009 report for its <i>Pacific Lamprey Passage Improvements Implementation Plan 2008 – 2018</i>, <a href="http://nwpapps.usace.army.mil/environment/docs/afep/system/Lamprey_10yrPlan_FINAL.pdf">http://nwpapps.usace.army.mil/environment/docs/afep/system/Lamprey_10yrPlan_FINAL.pdf</a> does not contain a statistical study plan for evaluating overall passage efficiency to detect improvements to adult passage in the FCRPS. Qualitative comparisons of index fishway window passage counts and HD PIT detections appear to be the method of evaluation.</p>
<p>YN 2/21/14 Draft Report comments</p>	<p><b>Section 5, Page 29.</b> It is disappointing that some concluding discussion is not brought forward in the paragraph after the tables. Isn't there room for some interpretation? Several conclusions can be made, frankly, and should be stated in the next draft: 1) the sample size of the first two years is very low and significant additions to the sample are required to make reasonable progress in determining adult passage success and/or areas in the fishway where additional considerations/improvements are warranted, 2) detection probabilities probably should be improved to provide for more defensible data, and 3) passage, as measured so far, is likely to fall below a standard that the RRF may hope for.</p> <p>Additionally, some discussion about where fish might be getting hung up in the fishway is warranted.</p>	<p>Additional HD PIT tagged fish moving through the Rocky Reach fishway are needed to evaluate ladder modifications and overall passage efficiency. 2014 is the third monitoring year. More fish are expected at Rocky Reach in 2014 from an additional 500 lamprey being tagged for McNary Dam passage studies.</p> <p>There is no direct evidence from HD PIT tag monitoring that fish are getting hung up in the fishway. Any suggestion of possibilities would be speculation at this time.</p> <p>The PIT tag monitoring currently ongoing is to assess success of the fishway modifications designed and approved by the RRF. The current study is not designed</p>

Commenting Agency	Agency Comment	Chelan PUD Response
	<p>Finally, there is no discussion about entrance efficiency - and this should be a major consideration.</p>	<p>to be an entrance efficiency study. That study was conducted in 2004. That study measured an overall <b>entrance efficiency</b> of <b>0.9402</b> (SE=0.0219) and a <b>passage efficiency</b> of <b>0.5545</b> (SE=0.0474). The RRFF has brought forward no hypotheses and no discussion has occurred as to why entrance efficiency with additional improvements made, would be <i>lower</i> than the 94.02% efficiency first measured in 2004 with <i>no improvements</i>.</p> <p>In 2013, 1,625 adult lampreys were enumerated passing the counting window at the top of the fishway. 2,155 adult lampreys were enumerated at the Rock Island fishway window. This rough unadjusted (unadjusted for adult escapement to the Wenatchee River) passage rate for Rocky Reach is 75.4%.</p>
<p>YN 2/21/14 Draft Report comment</p>	<p><b>Section 5, Page 30.</b> I am not sure why there is such an emphasis on the Juvenile Bypass System. If anything, I suppose, it should be noted that it is likely that juvenile lamprey will be exposed to all turbine intakes prior to reaching the JBS. Also it is becoming better recognized in other parts of the Columbia River Basin that a significant number of juveniles move in winter storm events, prior to the operation of the JBS, so it is likely that a majority of the lamprey are not counted due to the operation schedule of the JBS. Anyway - none of this matters much, but it is odd that at the end of Paragraph 6, a conclusion is made that the "reduced numbers counted in 2012 and 2013 is a likely result of reduced sampling times, when there is no discussion of the amount of sampling during this time period. It is probably more likely that there just are not many eels above Rocky Reach anymore. This is an important and a viable hypothesis that should be provided in this document.</p>	<p>Comment noted. Rocky Reach License Article 5 for Pacific lamprey specifies Chelan PUD to operate downstream fish passage facilities (Rocky Reach Bypass System) in accordance with the operation criteria for anadromous salmonids and compatible with bull trout migration guidelines set forth in the HCP and annual Fish Passage Plan. Secondly, it is very unclear to us how juvenile lampreys would be physically exposed to all turbine intakes prior to reaching the JBS. This is not possible. In 2011, the bypass system was sample around-the-clock clock for 20 minutes each hour for approximately 40 days as part of the HCP juvenile Chinook study. In contrast, in 2012 and 2013 the bypass was sampled for one-half hour each hour from 8am-11am during its normal index period in the morning. No data or hypotheses are set forth in this report regarding the</p>



Commenting Agency	Agency Comment	Chelan PUD Response
		potential abundance of juvenile lamprey upstream of Rocky Reach. It is not the purpose of the Biological Objectives report to synthesize unsupported hypotheses on the abundance of lamprey upstream of Rocky Reach.
YN 2/21/14 Draft Report comments	<b>Section 5, Page 30.</b> ideas -- speculated?	The word “theories” highlighted in the YN comment has been changed to “possibilities” in the second draft report.
YN 2/21/14 Draft Report comments	<b>Section 5, Page 32.</b> It would serve this discussion well to indicate that in general monitoring these screens was done on a pretty limited basis. We do not yet understand triggers or timing of downstream movements of juveniles so it is probable that we have missed some of these events. Additionally, it should be noted that juvenile lamprey left dead in the screens for just a couple days would become covered with fungus and difficult to actually see. Finally - it is likely there are very few juvenile lamprey above the Project, so finding them just from this perspective is problematic.	Monitoring was conducted on the frequency put forth and accepted by the RRFF as documented in RRFF meeting minutes. The RRFF reviewed and approved a screen monitoring methods proposal on March 19, 2010. The RRFF approved bi-annual monitoring of turbine screens in Units 1 and during its meeting on <b>2 February 2011</b> . There is no information available to conclude or speculate that any juvenile lamprey impinged on C1 and C2 turbine screens for a couple of days would become covered in fungus and difficult to see. Over at least three years, screen monitoring has yet to positively identify any juvenile lamprey impinged. If impingement was significant, this monitoring would be more than sufficient to identify it, but has not. It is not the intent of screen monitoring to determine the abundance of juvenile lamprey upstream of the Project.
YN 2/21/14 Draft Report comments	<b>Section 5, Page 32.</b> What is the mesh size opening of C1 and C2 Turbine diversion screens? Since juvenile lamprey come in sporadically in large numbers, wouldn't it be easy to miss these peaks unless we monitor [screens] every day? In a matter of a few days, dead lamprey will be covered in fungus and it would be impossible to ID them as lamprey	Mesh size of C1 and C2 Unit intake screens is 1/8” (3.175 mm). Screen cleaning and video monitoring for impingement occurs at Rocky Reach when river flow and debris load increases. Existing information on juvenile lamprey movement downstream to Rocky Reach indicates that fish move with higher flows in tributaries and the mainstem. Impingement monitoring occurs during these

Commenting Agency	Agency Comment	Chelan PUD Response
		<p>conditions and has been sufficient for the RRFF to conclude that monitoring can move from an annual to a biannual schedule. Additionally, screens exist in only two Rocky Reach turbine units, and only cover only the upper portion of the turbine intakes which maybe why observations over three years of spring monitoring have not shown any significant impingement to this point.</p>
<p>YN 2/21/14 Draft Report comments</p>	<p><b>Section 5, Page 33.</b> Paragraph 16 (beginning "The RRFF concluded that bi-annual monitoring...") is misleading and should be corrected. First, the RRFF did not "request" that no further monitoring of screens is needed, but agreed to a CCPUD proposal that this was probably not the best use of time and money.</p>	<p>The RRFF reviewed and approved a screen monitoring methods proposal on March 19, 2010. The RRFF approved bi-annual monitoring of turbine screens in Units 1 and during its meeting on <b>February 2, 2011 RRFF meeting:</b></p> <p><u>Lamprey Impingement Monitoring</u>                      Juvenile lamprey impingement monitoring would normally occur annually between 15 April and 15 June. However, because of the very low incidence of impingement observed over the past several years, the RRFF determined that annual reporting of juvenile lamprey impingement monitoring under FWS prescription article 5(b)(2) would be necessary only bi-annually. Bi-annual reviews will occur to evaluate the necessity to reinstate the annual monitoring and reporting.</p>
<p>YN 2/21/14 Draft Report comments</p>	<p><b>Section 5, Page 33.</b> The last sentence is a giant leap and is to be withdrawn. The RRFF has never stated that the Biological Objective safe volitional passage through the turbine intakes is being maintained. This statement is simply not truthful</p>	<p>Comment noted.                      The RRFF approved bi-annual monitoring of Rocky Reach Unit 1 and 2 turbine intake screens, and at this time the RRFF has requested no further action other than bi-annual monitoring of the screens. The next screening monitoring year will be spring 2015 at Rocky Reach. Other than turbine unit screen monitoring, the Biological Objective of monitoring volitional downstream passage has not been evaluated, primarily due to lack of marking and recapture</p>

Commenting Agency	Agency Comment	Chelan PUD Response
		technology.
<p>YN 2/21/14 Draft Report comments</p>	<p><b>Section 5, Page 33.</b> Paragraph 17 (beginning "Section 4.2.3 of the PLMP requires..."): includes the statement that "<i>Chelan PUD shall ... develop the means to provide sufficient numbers of juvenile lamprey for these evaluations</i>". The discussion then goes on extensively (several pages) about the efforts the RRFF have put into understanding the role of Artificial Propagation to help meet the needs explicitly stated in Section 4.2.3. But there is no conclusion about where this discussion has gone. To state in Paragraph 40 (beginning with "Significant progress has been made...") that this is being discussed in the RRFF couldn't be farther from the truth -- it is being wholly avoided and Chelan PUD is mostly responsible for shutting off this discussion. Whatever is trying to be stated in this document is not only confusing, but mis-leading, at best. Chelan PUD is not making progress in this regard, but hindering it.</p>	<p>Comment noted. Artificial propagation, if chosen as the means to provide juveniles, was intended explicitly to provide juveniles for downstream passage studies. The words <i>artificial propagation</i> are not found anywhere in the Rocky Reach Pacific Lamprey Management Plan. There is no language we are aware of in the Pacific Lamprey Management Plan, or Settlement Agreement, which discusses any other purpose for rearing juvenile. Artificial propagation is one of several other possible alternatives to provide juveniles for study. To recap with accuracy, the exact language in Section 4.2.3 of the PLMP: "<i>Specifically these methodologies will address juvenile lamprey downstream migration timing and passage survival through the Project. Associated with these methods, Chelan PUD shall, in consultation with the RRFF, develop the means to provide sufficient numbers of juvenile lamprey for these evaluations.</i>" Again, juvenile tagging studies are not feasible at this time to measure downstream passage survival, and no studies have been conducted. No active tag for measuring Project Effects was available in the last five years for this purpose, and to date, no tag is yet available that has been built, performance tested for battery life and physical effects on juvenile lamprey, or released to the public for purchase and use.</p>
<p>YN 2/21/14 Draft Report comments</p>	<p><b>Section 5, Page 33.</b> Paragraph 19(beginning "Laboratory studies have been conducted...") concludes by itemizing some excerpts from the effects analysis table. This discussion is completely mis-leading and must be re-characterized or deleted completely. First</p>	<p>Comment noted. Please check your reference to report language. The language in the report states: <i>The RRFF has not reached consensus on the effects analysis, and significant discussions continue at present</i></p>

Commenting Agency	Agency Comment	Chelan PUD Response
	<p>and foremost, this effort never got off the ground and the RRFF quickly ceased working on this table when we concluded that there just wasn't enough information to characterize, in a meaningful way, the elements to be included in the table. Given that this effort never really went forward, it is a complete misrepresentation to include in this document that the RRFF concluded and have consensus on the 4 excerpts. The only thing that was concluded - if anything - was that predation in the turbine boils is probably a Project Effect that likely exists and that we could do something about. There is no mention of that conversation. It is recognized that in Paragraph 20 "The RRFF has not reached consensus on the effects analysis...". If that is the case, then the excerpts should be withdrawn from the document as their inclusion, as stated, is a misrepresentation.</p>	<p><i>regarding the type and magnitude of ongoing Project effects, corrective actions, data needs, and area and level of responsibility.</i></p> <p>All references to “conclusions” have been removed from the paragraph in the revised report. This was a significant effort by the RRFF to identify potential effects and so will remain in the report.</p> <p>The study data cited in this section is actual professional scientific research that is published and reviewable. Citations are provided. These are not the conclusions of Chelan PUD or the RRFF, but the authors who conducted the research and published the results. The RRFF drew no conclusions and made no decisions based on the research data provided in the Effects Table.</p> <p>Predation in the tailrace of Rocky Reach Dam was discussed along with other possible effects. No conclusion was reached and no data exists to support predation on lamprey by the native minnow, northern Pikeminnow in the “turbine boils”. We encourage the YN to bring any and all published scientific research on effects to juvenile lamprey from hydropower projects. Chelan PUD will enter this data into the effects table for RRFF review.</p>
<p>YN 2/21/14 Draft Report comments</p>	<p><b>Section 5.2, Page 33.</b> This is inaccurate info. In reality turbine strike is a serious problem for eels – I can find many studies that describe that, but we are just showing one rare study that found 100% survival in eels in the short term (not overall survival rates) and describing it as though that’s the norm with eels (completely inaccurate) and trying to make the case that it applies directly with</p>	<p>No information reported is inaccurate. No inference is made in this report to effects on Pacific Lamprey. The juvenile eels studied and reported on in Amaral et al 2008 were larger, approximately 300 mm in length. There is no language in the report referencing these study conclusions as the “norm”. For our reference, please provide the many</p>

Commenting Agency	Agency Comment	Chelan PUD Response
	lamprey (completely different sizes).	studies you possess on turbine blade strike effects on juvenile Pacific lamprey.
YN 2/21/14 Draft Report comments	<b>Section 5.2, Page 33.</b> How long is delayed? One day, one week, one month?	Please see Colotelo et al. 2012 for detailed results of turbine pressure tests conducted during their research.
YN 2/21/14 Draft Report comments	<b>Section 5.2, Page 33.</b> Same comment above in reference to RRFf concluding that biannual monitoring of turbine intake screens is acceptable based on the existing data demonstrating a “very low incidence of impingement”	Comment noted. Same response as above.
YN 2/21/14 Email	<b>Section 5.2, Page 34.</b> The YN recognizes that much of this narrative is a reflection of past documentation. However, significant progress has been made in the past couple years that is not included, leading the reader to mistaken "the stat of the art". This should be corrected, as noted below.	Comment noted. This report discusses the Juvenile Lamprey Artificial Propagation Manual and other research over the previous five years. It makes no conclusions or assumptions about current or future state-of-the art research conducted by others in more recent periods. Chelan PUD is unaware, as mentioned in the YN comment, of any documentation, research, results, or significant progress on state of the art work propagation work that has been provided to the RRFf for review.
YN 2/21/14 Draft Report comments	<b>Section 5.2, Page 34.</b> Why would you want to produce adults? Macrophthalmia is probably the oldest age we are shooting for.	Comment noted. This language comes directly from Ostrand et al. 2011. It is simply a statement made in the report, no conclusions offered.
YN 2/21/14 Draft Report comments	<b>Section 5.2, Page 34.</b> We are producing roughly 10,000 larvae currently at Prosser Fish Hatchery (and we can do much better next year). Is that still not a production scale?	Comment noted. The RRFf has not been provided any report information on larvae production at the Prosser Hatchery for review.
YN 2/21/14 Draft	<b>Section 5.2, Page 34.</b> The only difficult part is between prolarvae (just hatched) to larvae – we see high mortality in that stage.	Comment noted.

Commenting Agency	Agency Comment	Chelan PUD Response
Report comments	However, once we're past that stage, we've seen nearly 100% survival. So rearing larvae is very easy and art. prop. of adults is easy as well – just need to figure out the best environment for prolarvae to transition to larvae.	
YN 2/21/14 Draft Report comments	<b>Section 5.2, Page 34.</b> We don't need to rear them to adults.	Comment noted.
YN 2/21/14 Draft Report comment	<b>Section 5.2, Page 35.</b> This paragraph discusses the conclusion that development of efficient technologies will "likely involve the collective efforts of the fisheries researchers, fish culturists and nutritionists". Well, in fact the YN, CTUIR, USGS and USFWS provided exactly that proposal to the RRFF and the RRFF not only rejected the proposal, but did not discuss how these efforts could be advanced. And, Chelan PUD was also against the effort, in spite of the explicit language described above in Section 4.2.3 of the PLMP. Since several pages of this Status Report were devoted to the development of artificial propagation - why would this situation be completely absent from the narrative? Why not include a discussion as to why CCPUD voted against the explicit language in the PLMP (shall develop means to provide sufficient numbers...")? Why would we not discuss where we think we are going with regards to this directive in the PLMP?	Comment noted. Artificial propagation, when and if necessary, is for the explicit purpose of providing study animals for downstream juvenile passage studies when studies are feasible and can be conducted. Juvenile studies are not feasible at this time, and have not been conducted. No active tag for measuring type and magnitude of effects on downstream passage currently exists today, or in the last five years for this purpose. The directive of the PLMP is for Chelan PUD, in consultation with the RRFF, to develop the means to provide sufficient numbers of juvenile lamprey for downstream study evaluations. Chelan PUD may, in consultation with the RRFF, suggest an alternative means to provide migrating macrophthalmia for downstream passage studies, such as collection of fish at the Dalles or John Day dams in concert with Army Corp of Engineers efforts to collect and study juvenile lamprey passage at FCRPS Projects.
YN 2/21/14 Draft Report comment	<b>Section 5.2, Page 36.</b> Mortality is significantly low after the prolarvae stage. Not true.	Comment noted. Text provided summarizes information in the Wade and Beamish Report (2012) and is not a conclusion of Chelan PUD or results based on other research.
YN	<b>Section 5.2, Page 36.</b> This statement is not true. The Yakama	Comment noted.

Commenting Agency	Agency Comment	Chelan PUD Response
2/21/14 Draft Report comment	<p>Nation and Umatilla Tribes have (1) incubated large numbers of eggs, (2) reared large numbers of juveniles and (3) developed protocol for continued rearing in 2014 and beyond.</p> <p>An additional paragraph must be included that recognizes the Yakama Nations and Umatilla Tribes considerable efforts since this document was released, where we have spawned and reared considerable numbers of juveniles, as was stated we would do in the proposal referenced above. Recognizing that this is a status report specific to the RRFF, it is an insult to the YN and CTUIR to completely neglect that recent work is ongoing and promising, especially because it is being done by two signatures of this Settlement Agreement.</p>	<p>Text provided in the report is specific to information and conclusions in the Wade and Beamish Report (2012), and is not a conclusion of Chelan PUD or the RRFF, or conclusions from other research being conducted on juvenile lamprey propagation.</p> <p>Chelan PUD is unaware of any studies supplied to the RRFF for review of this recent work as referenced in this comment. Sentence added to reference propagation work by the YN and CTUIR.</p>
YN Email on 7 May 2014 to Steve Hemstrom and Lance Keller Chelan PUD	<p><b>Email:</b> “With regards to Ralphs comments, it was pretty clear to me that he didn’t have a very good context of some of the information you wrote - specifically - you were documenting what was stated several years ago (with regards to the lamprey art prop documents). He was/is pretty tied up with the art prop work he is doing now - so I think the easiest / best way to address his comments is just a simple paragraph that acknowledges the current work that has moved the ball forward from the past couple years. Hope that helps - let me know and I can draft the paragraph if needed. Thanks - Best.”</p>	<p>5/7/14 email comment noted.</p> <p>Language was added to the revised report to identify that work and progress have been made recently by YN and CTUIR on artificial propagation of Pacific lamprey.</p>
YN 2/21/14 Draft Report comment	<p><b>Section 5.2, Page 37.</b> Skalski (2012) reported that... a large sample size of 7,000 - 18,000 fish would be required to achieve an adequate statistical survival estimate. This is followed by the statement that conducting this is prohibitive at this time. Is this because of a lack of test fish? IF so, I reference Section 4.2.3 in the PLMP and my comments above. Additionally - if the</p>	<p>Comment noted.</p> <p>No, the lack of test fish specifically is not the primary issue. Migrating macrophthalmia could be collected at John Day or the Dalles Project if necessary in the near future to begin initial testing if tags were commercially available, performance tested, and tag insertion methods developed.</p>

Commenting Agency	Agency Comment	Chelan PUD Response
	<p>statistical power is required with juvenile studies, why is this conversation completely neglected with adult passage studies? There is a gaping hole in the logic provided in this narrative. However - it is recognized that the remainder of this paragraph is accurate in characterizing the many problems with juvenile studies, but this does not mean that we cannot move forward. I will include here that in spite of these difficulties, I don't recall where CCPUD has pressed for these discussions to be forthcoming on RRF agenda, rather, there seems to be little interest in these discussions.</p>	<p>For clarity, the sentence has been revised to say “<i>Acquiring this number of migrating macrophthalmia that exhibit 100 percent migratory behavior (tagged fish cannot stop, delay migration, or overwinter) makes the ability to conduct a survival study prohibitive at the current time.</i>”</p> <p>Additionally, as mentioned prior, the lack of small, long-life acoustic tags is the primary technological limitation precluding juvenile studies. PIT tag studies have no ability to determine project passage routes or effects, but can only produce a survival estimate. Statistical rigor and small standard errors on estimates (which requires a larger sample size) are needed for juvenile studies to determine migration path, dam passage route and survival with certainty so that effort can be applied accurately to reduce right source of mortality identified during the study. Adult lamprey numbers are not available by the thousands to allow this type of statistical analyses.</p> <p>The adult passage evaluation at Rocky Reach is to assess fishway modifications made and the efficacy and benefit for lamprey passage. This evaluation is ongoing and substantially different than a mark-recapture juvenile passage study at Rocky Reach.</p>
<p>YN 2/21/14 Draft Report comment</p>	<p><b>Section 5.2, Page 37.</b> This is the high estimate, but we can still conduct a study with less fish (just a matter of balancing the precision levels).</p>	<p>Lack of active acoustic-tag technology is the limiting factor for juvenile studies. Additionally, to reduce the precision of survival estimates, as suggested here to allow use of fewer test fish, is neither wise or a recommended scientific study modification when the intent of studies to draw well supported conclusions on Project effects, and</p>



Commenting Agency	Agency Comment	Chelan PUD Response
		more importantly, to define what passage element is causing a mortality effect. This cannot be accomplished efficiently with imprecise estimates.
<p>YN 2/21/14 Draft Report comment</p>	<p><b>Section 5.2, Page 37.</b> This statement is true but it would be more accurate to state that the PNNL, through the USACE has begun investigations to build such a tag and is expected to have one available within the next 2-3 years.</p>	<p>Comment noted. Prior to any commercial availability, we also note that significant rigorous pilot testing is also planned by PNNL to identify potential tag effects on juvenile lamprey health, physiology, behavior, and swimming ability before these tags are used to estimate passage survival at any FCRPS Project. It is not known at this time whether juvenile lampreys will accept this tag with no physiological effect that could bias passage survival estimates. See Sources Sought solicitation for lamprey acoustic tag development requirements here, released May 10, 2013. <a href="https://www.fbo.gov/index?s=opportunity&amp;mode=form&amp;id=1e2c1b468b541efde874903d0b3d06d4&amp;tab=core&amp;tabmode=list&amp;=">https://www.fbo.gov/index?s=opportunity&amp;mode=form&amp;id=1e2c1b468b541efde874903d0b3d06d4&amp;tab=core&amp;tabmode=list&amp;=</a> We believe any tested, commercially available tag produced for juvenile lamprey passage studies is much further away than 2-3 years.</p>
<p>YN 2/21/14 Draft Report comment</p>	<p><b>Section 5.2, Page 37.</b> But is being invented right now (JLAP tags)</p>	<p>Comment noted. A prototype JLAT (Juvenile Lamprey Acoustic Telemetry) tag is in research and development by Pacific Northwest National Laboratory (PNNL).</p>
<p>YN 2/21/14 Draft Report comment</p>	<p><b>Section 5.2, Page 37.</b> If we are tagging macrophthalmia, we don't have this problem</p>	<p>Comment noted. The migration behavior of macrophthalmia and duration of time for reservoir passage through any upper Columbia reservoir like Rocky Reach are unknown. For example,</p>

Commenting Agency	Agency Comment	Chelan PUD Response
		<p>Please see Close (1995) regarding Pacific Lamprey macrophthalmia migration:  <i>The young adults from some populations can stay in fresh water up to 10 months after metamorphosis, although different populations in British Columbia vary in their ability to survive confinement in freshwater (Beamish 1980). Confined Babine River lamprey did not survive past February, while Chemainus River fish survived until July (Clarke and Beamish 1988) The onset of mortality was associated with decrease in plasma sodium concentration and condition factor (Clarke and Beamish 1988).</i></p>
<p>YN 2/21/14 Draft Report comment</p>	<p><b>Section 5.2, Page 37.</b> Again we don't have this problem with macrophthalmia</p>	<p>Same response as above.</p>
<p>YN 2/21/14 Draft Report comment</p>	<p><b>Section 5.2, Page 37.</b> This paragraph probably needs to be re-worked to dissect the notion of juvenile studies from the NNI discussion. But, given that, I don't think it is fair to say that the NNI discussion, and its various components is "being debated heavily" within the RRF. I think it is more accurate to say that this discussion has been avoided, more than not, as it has gone on for over one year and Chelan PUD has not contributed anything to the discussion other than negativity, to date. This discussion should be more accurately portrayed in the Status Report.</p>	<p>Comment noted. The words "debated heavily" have been changed to "discussed" in the second draft report.</p>
<p>YN 2/21/14 Draft Report comment</p>	<p><b>Section 5.3, Page 38.</b> In general this Section is well written, but there are important considerations that should be incorporated. First, it should be clarified that the sum total effort to date for sampling is approximately 90 minutes. For a reservoir this size, with respect to one of the four PLMP Objectives, 90 minutes of</p>	<p>Comment noted.</p>

Commenting Agency	Agency Comment	Chelan PUD Response
	<p>field time is not a significant effort. It is accurate to say that this was a very preliminary and considered a pilot effort. The RRF decided that this Objective was of secondary importance at the time, and concluded that it is best to put it into "the parking lot" until a more comprehensive effort can occur.</p> <p>But it is not accurate to suggest under Objective 3 (Determine potential effects of Project operations on juvenile lamprey) that juvenile lampreys are not present in areas of fluctuation - so there is no Project Effect. Clarification is needed. Did the fluctuations kill the lamprey? Did the lamprey move due to fluctuations? Did they go deeper in the sediments? We just don't know, and that is what should be reflected. It is also important to state here that there just are not very many lamprey above Rocky Reach, so it is not expected to find considerable numbers of lamprey in any of the habitats. That is not to say there will not be an impact when lampreys are recovered.</p>	<p>Sentence was added to the revised report, "but certainty of presence or absence due to reservoir operations is not known with the sampling that was conducted" to Objective 3 description.</p>
<p>YN 2/21/14 Draft Report comment</p>	<p><b>Table 5-6, Page 40.</b> What about the date? What was the temperature? If it's done in the fall/winter, it is harder to catch them due to lower temperature. What was the electro-fishing settings? Was it done at a time when the water levels was high, low, intermediate? Without this info, the results could mean completely different things. If it's at a high flow, lamprey are probably not going to be in the margins (as the flow can be unstable). Just a day of sampling is not going to give an accurate info on lamprey presence in the reservoir water.</p>	<p>Comment noted. Specific details requested in this comment are found in the March 2012 report: <i>ROCKY REACH PACIFIC LAMPREY MANAGEMENT PLAN Distribution, Composition, and Abundance of Juvenile Lampreys (Lampetra sp.) within the Observed Operating Range of Rocky Reach Reservoir, 2011</i></p> <p>Link to report provided: <a href="http://www.chelanpud.org/documents/38313_Juvenile_Lamprey_Reservoir_Sampling_Study_Report_03-01-">http://www.chelanpud.org/documents/38313_Juvenile_Lamprey_Reservoir_Sampling_Study_Report_03-01-</a></p>

Commenting Agency	Agency Comment	Chelan PUD Response
		<a href="#">12_.pdf</a>
YN 2/21/14 Draft Report comment	<b>Table 5-6, Page 40.</b> This is not enough time to really evaluate presence/absence. You can only cover about 6~10 m2 with this kind of time.	The electro-shocking effort, sampling areas, and sampling design were not indented to constitute a full-census presence/absence evaluation in Rocky Reach Reservoir.
YN 2/21/14 Draft Report comment	<b>Section 5.3, Page 41.</b> There should be an overall conclusion to this table that includes, at a minimum that the effort was considered simply a pilot, and that the amount of time spent sampling is considered a small amount of time that is actually needed to provide the information necessary to adequately begin addressing this objective.	Following Paragraph after Table 5-6 is revised to include that this evaluation was a “first evaluation”. There is no language in the RRF meeting notes or 2012 Study Report using the words “pilot study”.
YN 2/21/14 Draft Report comment	<b>Section 5.3, Page 40.</b> Can we state exactly what is the max, mean, and min daily fluctuation in feet (using numbers) rather than these arbitrary words?	Rocky Reach full Reservoir elevation is 707 ft above mean sea level (msl). License minimum is 703 ft msl. Rocky Reach <i>mean hourly</i> (8,760 hours) reservoir elevations each year from 2005-2008 were, 705.91, 705.86, 705.87 ft msl, and 705.85, respectively. Median hourly elevations were 705.97, 705.88, 705.96, and 705.86, respectively. Lowest Rocky Reach hourly elevation recorded each year 2005-2008 was 703.80 ft, 703.14 ft, 703.32 ft, and 703.65, respectively. This data demonstrates the description of stable Rocky Reach Reservoir elevations is not arbitrary, but accurate and factual. Reservoir elevations are stable within four feet, and the average annual hourly reservoir elevation is only about 1.1 feet below maximum elevation of 707 ft msl.
YN 2/21/14 Draft	<b>Section 5.3, Page 41.</b> Is that because the ones that rear in there are getting eliminated due to the water level changes? Do we know?	Reservoir sampling intended to find juveniles rearing in or using shallow water areas. Shocking was conducted by the

Commenting Agency	Agency Comment	Chelan PUD Response
Report comment		US Fish and Wildlife Service. There is no ability to know why juvenile lampreys were <i>not found</i> in certain locations or shallow areas of Rocky Reach Reservoir.
YN 2/21/14 Draft Report comment	<b>Section 5.3, Page 41.</b> Again, maybe they are not present because those that stay in there are being eliminated due to the water level changes. To conclude that there is no impact on lamprey because we didn't find them there in one day of survey is very bad science.	The referenced paragraph of the report containing this comment does not state that no impact occurs. To clarify, the paragraph states: <i>“The sampling crew believed that the location at which the juveniles were collected was deeper than the lowest point of reservoir fluctuation, thus protecting the juveniles from becoming dewatered or stranded. If true, then the sampling conducted in 2011 indicates that juvenile lamprey were not present within suitable habitat within the area of reservoir fluctuations.”</i> There are no significant deep drafts of Rocky Reach reservoir as shown by data in table
YN 2/21/14 Draft Report comment	<b>Section 5.3, Page 41.</b> I would recommend that we examine this again (we need to think wisely about how to device the study, though, to capture the real impacts).	Comment noted. The USFWS devised the juvenile lamprey sampling plan and carried out the sampling at chosen areas within Rocky Reach Reservoir in 2011. The RRF reserves the ability to continue to discuss reservoir habitat and potential effects of reservoir operation.
YN 2/21/14 Draft Report comment	<b>Section 5.3, Page 41.</b> At the end of this Section, there is a summary of the objectives and a discussion of NNI. The Adaptive Management process identified in the 401 Certification is also a central component of the PLMP but is not included anywhere in this Status Report. This is important because it identifies: <i>Within this Certification, Ecology has required the use of an Adaptive Management process to meet a number of State water quality standards. As used in this Certification, Adaptive Management means an <u>iterative and rigorous process</u> used to improve decision-making and achieve objectives in the <u>face of uncertainty</u>. It is intended to improve the management of natural</i>	Chelan PUD is not certain of the accuracy of this YN comment with respect to language contained in the 401 Certification. The Rocky Reach 401 Certification does not contain the explicit language as stated in the YN comment. Instead, the Rocky Reach Settlement Agreement contains this referenced language, not the 401 itself. Please see 401 language in reference to Adaptive Management below:  <u>Page 7, Rocky Reach 401 Certification, March 17, 2006, states :</u>

Commenting Agency	Agency Comment	Chelan PUD Response
	<p><i>resources affected by Project in order to <u>achieve desired objectives as effectively and efficiently as possible</u>. For purposes of this Certification, Adaptive Management involves the following steps:</i></p> <ul style="list-style-type: none"> <li>• <i><u>Develop initial hypothesis</u> regarding any Project effects and potential remedial measures</i></li> <li>• <i><u>Develop objectives</u> for addressing such impacts</i></li> <li>• <i><u>Develop and implement</u> reasonable and feasible measures in accordance with an <u>established schedule</u></i></li> <li>• <i>Develop or identify monitoring and evaluation methodologies for determining whether such objectives have been achieved</i></li> <li>• <i><u>Monitor and evaluate the implementation</u> of such measures and their effectiveness toward achieving such objectives</i></li> <li>• <i>Review monitoring and evaluation efforts</i></li> <li>• <i>Confirm such objectives have been achieved or, if not achieved, evaluate additional or revised measures, and implement any appropriate and reasonable measures.</i></li> </ul> <p>This language is important, as considerable discussion has occurred within this 5-year review period on a number of topics, of which more resistance than action has been taken by Chelan PUD.</p> <p>An important question needs to be addressed and answered: How</p>	<p>“This Certification refers to and incorporates the HCP and various sections of the Comprehensive Plan, including the WQMP, the Bull Trout Management Plan, the Sturgeon Management Plan, the Lamprey Management Plan, and the Resident Fish Management Plan, which in turn refer or incorporate other documents, such as the Preliminary Draft Environmental Assessment. Ecology has conducted a sufficient review of the facts to execute and support the Settlement Agreement consistent with its statutory obligations. However, Ecology does not necessarily approve of all the statements or analyses (including without limitation interpretations of data, studies, and law) contained in the Comprehensive Plan and documents referenced therein. As stated in the definition of “Adaptive Management” in the Settlement Agreement, if goals and objectives have not been achieved, previously considered measures may be re-evaluated.”</p> <p>See WA Dept of Ecology 401 Certification for Rocky Reach:  <a href="http://www.ecy.wa.gov/programs/wq/ferc/existingcerts/rockyreach.pdf">http://www.ecy.wa.gov/programs/wq/ferc/existingcerts/rockyreach.pdf</a></p> <p>Chelan PUD has and continues to monitor potential Project effects on upstream adult passage at Rocky Reach, and the fishway improvements that have been made at Rocky Reach to increase passage efficiency. These measures are required in the License, and Chelan PUD has and continues to implement them. The potential project effects, if any, on downstream migrating juveniles have not yet been</p>

Commenting Agency	Agency Comment	Chelan PUD Response
	can the RRFF understand what the Project Effects are if the PUD refuses to fund	assessed due to reasons described above. There is no requirement in the PLMP for Chelan PUD to use unproven scientific methods or utilize technology that has not been commercially released or performance tested in an attempt to measure downstream migration effects on juvenile lamprey.
YN 2/21/14 Draft Report comment	<b>Section 5.4, Page 41.</b> This statement is mis-representative -- this may be CCPUDs assumption, but the fact is, we simply don't know, and the RRFF decided to "park" this activity for the while and work on other actions more pressing for lamprey at the time.	Comment noted.
YN 2/21/14 Draft Report comment	<b>Section 5.4, Page 43.</b> One last note: There is nearly 100% loss from the counting window of Rocky Reach to the counting window of Wells dams. Why is this simple fact not acknowledged in this Status Report? Is this not a significant fact - possibly the most significant fact of all the rest of background noise of speculation? Isn't neglect of communicating this factual information something akin to a bias, if not mis-information?	Chelan PUD has calculated and analyzed adult lamprey window count conversion rates (the ratio of the number of fish counted at the top of one Project fishway to the number counted at the top of the next upstream Project fishway) between Rock Island Dam and Rocky Reach Dam, and Rocky Reach Dam to Wells Dam. The RRFF is currently reviewing these data.
USFWS 3/6/14 Draft Report comments	<b>Section 3, Page 15.</b> This section [Section 3: Bull Trout] needs to summarize bull trout activities at the Tumwater and Dryden dams as well. My suggestion is to place this discussion into section 3.1.	Comment noted. Any Incidental Take of bull trout in years 2005-2008 at Tumwater and Dryden fishways and trapping during collection of anadromous broodstock for Rocky Reach Project Programs was covered by WDFW's Section 6 Incidental Take Permit, as specified in the USFWS' Biological Opinion to Chelan PUD issued on May 12, 2004. As a result, no Incidental Take authorization was issued to Chelan PUD from 2005-2008. However, WDFW permit records and Chelan PUD's monitoring reports indicate no lethal Take or injury occurred in 2005-2008. Because WDFW and the Yakamas conducts non-related

Commenting Agency	Agency Comment	Chelan PUD Response
		trapping which utilizes the traps simultaneously with Chelan PUD’s HCP brood collection and adult anadromous management activities, the potential Take of any bull trout has been reported by the WDFW and the Tribe under their permits. In the next 5-year Biological Objectives Status Report (2018) for the new Rocky Reach License, Chelan PUD will continue to report observation of bull trout trapped by these entities at Tumwater or Dryden fishways and traps. Any Take for <i>Rocky Reach Project Programs</i> will be reported for activities at Tumwater and Dryden for fishways and trapping related specifically to collection of broodstock only, as specified in Term and Condition #5 of the UFWS’ 2008 BiOp.
USFWS 3/6/14 Draft Report comments	<b>Section 3, Page 16.</b> Suggest taking the word “Revised” out of Table 3-2 description as it implies that the 2008 BiOp levels were revised.	Word “Revised” removed from Table 3-2 header.
USFWS 3/6/14 Draft Report comments	<b>Section 3, Page 18.</b> I suggest removing this statement because it’s now not entirely factual. It’s my understanding that CPUD has not “field checked” actual backwater areas based on this summary (I’m trying to remember if that’s true.). We are concerned that those water management events that encompass the remaining 10% of all hours could have some type of impact and should not be discounted.	Statement removed. Rocky Reach Reservoir may fluctuate up to four feet between elevation 703 feet above sea level and 707 feet, per the Project License. No entrapments are known to exist without continuous water connection to the mainstem at elevations in this operating range. Backwater areas do exist, but stranding and permanent entrapment cannot occur without loss of water connectivity to the mainstem for fish to escape. Additionally, the normal reservoir operations strive to achieve full or near full pool elevation daily.
USFWS 3/6/14 Draft Report	<b>Section 5, Page 27.</b> This is a tough nut to crack literally, but it must be recognized here that the scope and nature of lamprey passage data is quickly evolving and it is the recommendation of	Comment noted. Many unknowns remain about adult lamprey ladder passage behavior. The RRF has not specifically discussed achieving a 100%



Commenting Agency	Agency Comment	Chelan PUD Response
comments	the RRFF to strive for 100% passage. This clarification would be very helpful.	passage goal at Rocky Reach, and such a goal is not consistent with the passage goal agreed upon by Settlement Parties in the Rocky Reach Pacific Lamprey Management Plan. As stated, <i>striving</i> for the highest passage rate within existing goal framework is the intent, but not the mandatory goal in the Management Plan.
USFWS 3/6/14 Draft Report comments	<b>Section 5, Page 27.</b> This statement implies that no other modifications will be required at the Project, which I know is not the intent. Please clarify to include the potential for future ladder modifications/evaluations to ensure continuity in the lamprey sections.	Additional language was added to clarify that additional modifications may necessary if current passage monitoring of the initial improvements does not show passage improvement to a satisfactory level.
USFWS 3/6/14 Draft Report comments	<b>Section 5, Page 27.</b> This statement was a concern of the Yakamas as well, but as currently worded, this section is biased towards the high survival studies and needs to discuss other related studies	Statement re-worded to avoid appearance of bias. Additional language included to say existing turbine blade strike studies should be repeated and additional studies performed to confirm results. We are unaware of other related studies on juvenile Pacific Lamprey.
USFWS 3/6/14 Draft Report comments	<b>Section 5, Page 27.</b> I think the Yakamas were concerned by this discussion as well, but the tag technology is being developed at this time and needs to be discussed in this section.	Comment noted. While researchers are working to develop an acoustic tag having the necessary attributes to tag juvenile lamprey without physical effect to the animal allowing unbiased studies on juvenile lamprey, no tag was available from 2009 through 2013 or at the current time. Paragraph amended to incorporate this language.
Ecology 4/8/14 Email from Pat Irle to Steve Hemstrom Draft Report	Hi, Steve - I understand. Just a quick note to say that, after talking to Charlie and Chris Coffin, we propose that the due date for the BiOb report be pushed out further into the future. We do have a few items that may take some time (not necessarily hard work, but time) to address. We would like to see these included, so that each of the future 5-year reports will clearly address each of these items (as	Proposal noted on due date of 2014 Rocky Reach Biological Objectives Report.

Commenting Agency	Agency Comment	Chelan PUD Response
comments	<p>required by the 401 certification).</p> <p>Again, I know that you are very busy. For us, at this point, getting this document right is more important than meeting the deadline.</p> <p>Sincerely, Pat Irle</p>	
<p>Ecology 4/8/14 Email from Pat Irle to Steve Hemstrom Chelan PUD Draft Report comments</p>	<p>Hi, Steve –</p> <p>As we discussed, I’m providing a list of recommendations for the report. It is mostly changes to formatting to make it clearer that the requirements of the 401 certification have been addressed. After you review the following recommendations, just estimate the time it would take to complete the work and let us and Michelle know. I’m guessing that anywhere between 2-6 weeks would be okay with us.</p> <p>Our suggestions:</p> <ol style="list-style-type: none"> <li>1) In Table 1-1, please include a column that identifies the designated uses. (This was included as the first column in the original table.)</li> <li>2) In each subsection that has an objective, include the following: <ol style="list-style-type: none"> <li>a) The goal (at the beginning of the subsection). This is in each fish management plan.</li> <li>b) Headings for each of the sub-subsections (see full description of each title in last paragraph in the report’s Introduction): <ol style="list-style-type: none"> <li>1) Results of monitoring...</li> <li>2) Degree of achievement... And, include (from table 1-1), the evaluation timeframe</li> <li>3) Management options taken to attain Biological Objectives</li> <li>4) Any recommendations to meet the Biological Objectives</li> </ol> </li> </ol> </li> </ol> <p>You may want to change the order of these sub-subsections (does</p>	<p>Recommendations noted.</p> <p>All recommended changes were incorporated into the revised report except a suggested list of acronyms; the report is not heavy on use of acronyms and each acronym is identified within the text when first used. Such a list may be more useful to add in the next 5-year Biological Objective report.</p>

Commenting Agency	Agency Comment	Chelan PUD Response
	<p>it make sense to describe the management options taken to obtain the Biological Objectives, before you describe the degree of achievement?), but it would be very helpful if you kept them in the same order among all the sub-subsections.</p> <p>3) It can be helpful to include a list of acronyms with their complete wordings.</p> <p>If there is some reason that any of the above doesn't make sense to you, please let me know and I will try to correct it.</p> <p>Thanks for your help. Sincerely, Pat Irle</p>	
<p>Ecology 4/8/14 Email from Pat Irle to Steve Hemstrom Chelan PUD Draft Report comments</p>	<p>Thank you very much for being willing to make these changes and providing a good, solid report.</p> <p>I think it would be helpful to have the RRFF review it one more time, as I expect that there will be additional information/statements that they may want to review.</p> <p>If so, does this mean that you would like to use May 16<sup>th</sup> as the completion date for the next version, with additional time for review by the RRFF and addressing any additional comments?</p>	<p>Email noted.</p> <p>Yes, May 16 was the completion date target for draft # 2 of the Rocky Reach Biological Objectives Status Report. Due to the amount of time needed to address and incorporate the comments, Chelan PUD contemplates actual completion of the second draft and distribution to the RRFF on June 2.</p>
<p>WDFW 3/6/2014 Draft Report comments</p>	<p><b>Section 5, Pacific Lamprey, Page 27.</b> Passage information and information that can be used to improve passage is evolving rapidly. This new information will likely be used to improve passage at similar hydroelectric projects. As a result the upstream passage rate to meet this Biological Objective is not static. Ongoing discussions in the Rocky Reach Fish Forum in regards to</p>	<p>Comment noted.</p> <p>We expect that increased detail and further discussion with the RRFF will occur over the next full year, and beyond. Progress on achieving adult upstream passage success is ongoing and monitoring the substantial fishway improvements at Rocky Reach made by Chelan PUD also</p>

Commenting Agency	Agency Comment	Chelan PUD Response
	no net impact to lamprey have in been ongoing. Providing clarification would improve this document.	continues in 2014 as the third year. We are unsure what measures and what ongoing analyses (HD PIT tag monitoring in the fishway) we can further clarify. A graph has been added to demonstrate the conversion rates of adult lamprey between Rock Island Dam and Rocky Reach Dam, based on counts of adults passing the fishway count window at both Projects.
WDFW 3/6/2014 Draft Report comments	<b>Section 5, Pacific Lamprey, Page 29.</b> A brief discussion on how PIT tag detection at the tributaries would aid in determining overall passage success at Rocky Reach Dam, including possible hypothesis as to what the fate of the adults are. EG. fish entering tributaries, overwintering, mortality etc. A table of counts at PR, RI, and RR that illustrates the issue of missing fish between projects would be informative.	<p>Comment noted.</p> <p>Half-duplex PIT tag detection systems in tributaries would detect adult lamprey tagged with HD PIT tags. HD tagged adult lamprey that pass Rocky Reach, and are subsequently detected buy a HD PIT antenna in the Entiat River, would show that lamprey are leaving the mainstem, entering the Entiat, and not suffering mortality in Rocky Reach Reservoir. However, an HD detection system in the Entiat River would provide <i>very little</i> information on overall passage success at Rocky Reach. Such a system would provide useful information on <i>the proportion</i> of adult lamprey that escape to the Entiat. For example, if 2 of every 10 HD tagged lamprey that pass Rocky Reach enter and are detected in the Entiat River over a 3-4 year period, we could hypothesize that <i>about</i> 20% of all lamprey passing Rocky Reach utilize the Entiat for spawning.</p> <p>Chelan PUD has calculated adult lamprey dam-to-dam conversion rates using window counts (i.e., number of fish counted at the top of the fishway to the number counted at the top of fishway at the next dam upstream) between Rock Island Dam and Rocky Reach Dam, and Rocky Reach Dam to Wells Dam. The RRFF is currently reviewing these data.</p>

Commenting Agency	Agency Comment	Chelan PUD Response
WDFW 3/6/2014 Draft Report comments	<b>Section 5, Page 37.</b> Tag technology is currently being developed. A brief discussion of advances in tag technology would be helpful.	Discussion of active acoustic tag development by PNNL has been added to the revised report.
WDFW 3/6/2014 Draft Report comments	<b>Section 5, Page 42.</b> Preliminary timeline for implementation of actions related to these issues have been discussed in the Rocky Reach Fish Forum. Please insert an approximate timeline to ensure future implementation of these NNI actions.	Comment noted. Discussions in year 1-5 were focused on potential study issues, technology limitations, and beginning discussions on how alternative measures might be used to meet NNI if technology and study limitation preclude studies to determine unavoidable impacts. The RRFF has not discussed timelines, or approximate schedules for actions that the RRFF is without the means to implement. In 2014, we anticipate the RRFF will plan to assess adult lamprey escapement numbers to the Entiat River to aid in knowledge of lamprey movement after passing Rocky Reach Dam.
WDFW 3/6/2014 Draft Report comments	<b>Section 5, Page 42.</b> In addition, unaccounted numbers of adults in the reservoirs may be a Project effect and needs to be better understood	We have no viable hypothesis, data, or research that indicates that adult lampreys are perishing in Rocky Reach Reservoir after successfully passing Rocky Reach Dam. We know adult lamprey enter and utilize the Entiat River which is the likely the final destination for some or many of the “unaccounted for” fish, but we do not know how many at this time. The RRFF is reviewing a conversion rate analysis prepared by Chelan PUD to assist in answering the question on fate of adults in the reservoir, and potential work to detect the level of escapement into the Entiat River.